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The Feasibility of Increased Utilization of the Georges Bank Herring Stock

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THE FEASIBILITY OF INCREASED UTILIZATION OF THE GEORGES BANK HERRING STOCK

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

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This thesis is dedicated to my mother, Mrs. Annette Starr, who had never waivered in her support of my studies and my pursuits. Unfortunately, she can not share in the completion of this thesis.

STATEMENT OF PURPOSE

The United States has embarked upon a new era of commercial fisheries management and development with the enactment of the Fishery Conservation and Management Act of 1976 (FCMA). The primary objectives of the FCMA are "to take immediate action to conserve and manage the fishery resources found off the coasts of the U.S." and "to encourage the development of fisheries which are currently underutilized ... by the U.S. fishing industry...".

One of these underutilized stocks is the Georges Bank herring stock. The U.S. fishermen have traditionally not fished for the adult herring stock on Georges Bank due to the long steaming time back to port, the rapid deterioration of the caught herring, and the previous low price of adult herring. However, foreign nations have maintained a very large Georges Bank herring fishery. The foreign nations operated herring-processing vessels on Georges Bank and, therefore, were able to process a fresh, good-quality herring. Their harvesting vessels did not have to steam to and from port between each catch and, subsequently, the nations were able to utilize the resource on a more economically-efficient basis than were American fishermen.

With implementation of the FCMA, the access by foreign nations to the Georges Bank herring stock has been limited. This development creates an opportunity for the U.S. fishing fleet to begin to utilize this stock. However, there are no American vessels constructed to process adult offshore herring. The objective of this study is to analyze the

feasibility of operating an American-flag fish-processing vessel on Georges Bank to enable the U.S. fleet to harvest and process this currently underutilized stock.

The FCMA stipulates that the Regional Fishery Management Councils determine the Optimum Yield (OY) for any particular fishery. The OY is that amount of fish harvested at which the U.S. will receive the greatest benefits on a recurring basis. Once the OY is determined the Regional Council estimates the domestic catch for the given year. This amount is subtracted from the OY to determine the surplus, if any, of that fish can be made available as allocations to foreign nations. The present OY for the Georges Bank herring stock is 10,000 metric tons (MT) annually. The domestic catch also is estimated to be 10,000 MT annually, and therefore, there is no allocation allowed for foreign fishing of Georges Bank herring.

Foreign nations, however, have traditionally enjoyed tremendous harvests of this herring stock. As recently as 1975 the foreign harvest of Georges Bank herring was 143,000 MT, whereas in 1976 domestic fishermen only harvested 735 MT of herring from all offshore areas, including Georges Bank. The elimination of foreign competition and the present small U.S. offshore herring fishery offers an opportunity for the stock to rejuvenate to a substantial stock size which, in turn, should allow for expansion of the U.S. offshore herring fleet. The elimination of foreign harvests of Georges Bank herring has also created a greater demand in those countries for herring and herring products exported from the U.S.. American processors are attempting to fill that demand from harvests of the Gulf of Maine herring stock instead of the Georges Bank stock, although they realize that stock may soon be large

enough to provide a good harvest. The overtaxation of the Gulf of Maine herring stock has resulted in herring catch quotas being instigated by the Regional Council, in order for the Gulf of Maine stock to be able to rebuild itself.

The FCMA encourages U.S. development in fisheries which have previously been underutilized by the domestic fishing industry. The key to full utilization of the offshore herring stock is a good quality product--i.e. freshly frozen on board a fish-processing vessel. The operation of a fish-processing vessel on Georges Bank would provide a market for the fresh herring caught the same day by American fishermen. This study hopes to show that the operation of a fish-processing vessel can be a feasible enterprise with good returns to the operator, the fishermen, and the U.S. economy as a whole.

INTRODUCTION

On 1 March 1977 the United States unilaterally enacted the Fishery Conservation and Management Act of 1976 (FCMA, P.L. 94-265). Until this time the U.S. had been a member of the multinational and now essentially defunct fisheries body, the International Commission for the Northwest Atlantic Fisheries (ICNAF). In (ICNAF) the U.S. only had a limited voice in the management and the allocations of fishery resources in the Northwest Atlantic. The FCMA, however, has provided for exclusive U.S. fisheries management authority within the U.S. Fishery Conservation Zone (FCZ). The zone is contiguous to the U.S. territorial sea (of 3 miles) and extends to a distance of 200 nautical miles seaward from the baseline from which the territorial sea is measured.[1] The U.S. now exerts exclusive fishery management authority over all the fish within the FCZ (except for highly migratory species like tuna,) over all anadramous species, spawning in U.S. waters, throughout their migratory range (the migratory range does not include any foreign nation's territorial sea or the U.S. recognized equivalent of a FCZ) and over all Continental Shelf fishery resources within and beyond the FCZ.[2]

The authority of the U.S. has had far-reaching effects upon fishermen of all nations, including American fishermen. Foreign fishing fleets had consistantly harvested hundreds of thousands of metric tons

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[1] Fishery Conservation and Management Act of 1976, sect. 101, 90 Stat. 336 (1976).

[2] FCMA, sect. 2, 90 Stat.332, (1976).

of fish annually from waters near to American shores. During the 1960's and 1970's domestic fishermen were unable to effectively compete against these large, distant-water foreign fleets. In 1977, the foreign catch of fish and shellfish in the FCZ was 1.7 million metric tons, down 27% from the foreign harvest in 1976, before enactment of the FCMA.[1] All Foreign nations, wanting to fish within the FCZ, must sign a Governing International Fishery Agreement with the U.S., acknowledging the exclusive management authority of the U.S. as set forth in the FCMA.[2] The U.S. has provided in the FCMA certain guidelines for which to follow in the determination of who will be able to fish for the specific fishery resources.

According to the provisions of the FCMA the U.S. has established eight regional fishery management councils.[3] These regional councils shall "prepare and submit to the Secretary (of Commerce) a fishery management plan with respect to each fishery within its geographical area of authority..."[4] These fishery management plans (FMP) will contain all the measures that are "necessary and appropriate for the conservation and management of the fishery."[5] To this end the appropriate council and its respective staff will determine the optimum yield (and the maximum sustaining yield) for the givern fishery.[6]

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[1]U.S. Department of Commerce, National Marine Fisheries Service, Data Management and Statistics Division, Fisheries of the U.S., 1977 (Washington, D.C.: Government Printing Office, 1978) p. iv.

[2]FCMA, sect. 201, 90 Stat. 337 (1976).

[3]FCMA, sect. 302, 90 Stat. 347 (1976).

[4]FCMA, sect. 302, 90 Stat. 350 (1976)..

[5]FCMA, sect. 303, 90 Stat. 351 (1976). [6]Ibid.

The optimim yield is defined as:

> "... the amount of fish-- (A) which will provide the greatest overall benefit to the Nation with particular reference to food production and recreational opportunities; and (B) which is prescribed as such on the basis of the maximum yield from such fishery, as modified by any relevant economic, social, or ecological factor."[1]

The optimim yield (OY) is the basis for all catch calculations and possible allocations.

In addition to the OY the appropriate council will also determine "the capacity and the extent to which fishing vessels of the U.S., on an annual basis, will harvest the optimim yield..."[2] This calculation is referred to as the Estimated Domestic Catch (EDC). After the Council has determined the OY and the EDC for the particular fishery they will then decide if there will be any foreign fishing allowed in that fishery. In order to arrive at this decision the Council will deduct the EDC from the OY to determine if there is any surplus of fish that American fishermen are not expected to harvest. This portion of the OY, if a surplus does exist, can be made available for foreign fishing.[3] This amount is referred to as the Total Allowable Level of Foreign Fishing (TALFF).

The stipulation that the TALFF shall be calculated subsequent to the determination of the EDC has given Americans the preferential right to the fish as intended by the Act. In their quest for supplies of fish, foreign nations realzied that, even though, their harvests of fish in the FCZ were being limited their purchase and, therefore, supply of fish was not necessarily limited. Several foreign-flag

poorly written

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[1]FCMA, sect. 3, 90 Stat. 335, (1976).

[2]FCMA, sect 303, 90 Stat. 351, (1976). [3]Ibid.

factory ships entered into "joint ventures" with American fishermen, the American fishermen would harvest the fish and sell their harvests at sea to the foreign factory ships. The American processing industry found itself not totally participating in the benefits from enactment of the FCMA, and were not pleased with what they viewed as circumvention of the law itself.

On August 28, 1978, the U.S. Congress approved P.L. 95-354. This law provides for an amendment to the FCMA of 1976 (P.L. 94-265). In the original FCMA a preferential right to the fish species and stocks described in the FCMA had been provided for American fishermen.[1] This amendment, however, extended that right by establishing "a preferential right for U.S. processors similar to the preferential right the FCMA created for U.S. fishermen."[2] Now U.S. fish processors will have a priority to purchase the fish caught by American fishermen to the "... extent to which processing facilities of the U.S., on an annual basis will process that portion of the optimum yield that will be harvested by fishing vessels of the U.S. ..."[3] Therefore, as long as the U.S. processing industry has the capability to handle all the fish harvested by American fishermen they will have priority for that fish over the possible sale by American fishermen of their harvests to any foreign, fish-processing vessels. The term "United States fish processors" refers to facilities located within the U.S. for, and vessels of the U.S. used

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[1]U.S. Congress, Senate, Report on the Fishery Conservation and Management Act Amendments, S. Rept. 935, 95th Congress, 2d Session, 1978, p.5.

[2]Ibid.

[3]P.L. 95-354, Sec. 5, 92 Stat. 521 (1978).

or equipped for, the processing of fish for commercial use or consumption.[1]

The FCMA and its amendment has created a vast potential for expansion for the whole American fishing industry, including both the fishermen and the processors. Whereas, foreign nations had averaged 224,000 MT of adult sea herring per year for the decade prior to the enactment of the FCMA, they have only averaged 1,876 MT of herring per year for 1977 and 1978.[2]

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[1]P.L. 95-354, Sec. 3, 92 Stat. 519 (1978).

[2]NMFS, Fisheries, 1977, p. 13; and Fisheries, 1978, p. 15.

CHAPTER I

HERRING FISHERY

Stocks and Distributions

Atlantic sea herring, Clupea harengus harengus, can be found on both sides of the North Atlantic. The Northwestern Atlantic stocks are restricted in distribution by these natural boundaries: the North American continent to the west; the Gulf Stream to the south and east; and, the Labrador Current to the north.[1] Within these environmental boundaries the herring stocks roam about in dense schools in search of plankton--their primary food source.[2]

There are three herring stocks in the Northwest Atlantic. These stocks are: the Southwest Nova Scotia stock, under Canadian jurisdiction; the Gulf of Maine stock, ICNAF area 5Y; and, the Georges Bank/Southern New England stock, ICNAF areas 5Z and SA6.[3] Figure 1 shows the delineation of the geographical areas first promoted by ICNAF. This study will primarily be based upon the Georges Bank stock and the adaptation of a processing vessel operation to this stock. However, the catch allocations and management strategies proposed in the herring fishery management plan (FMP) and its amendments are based upon expected stock

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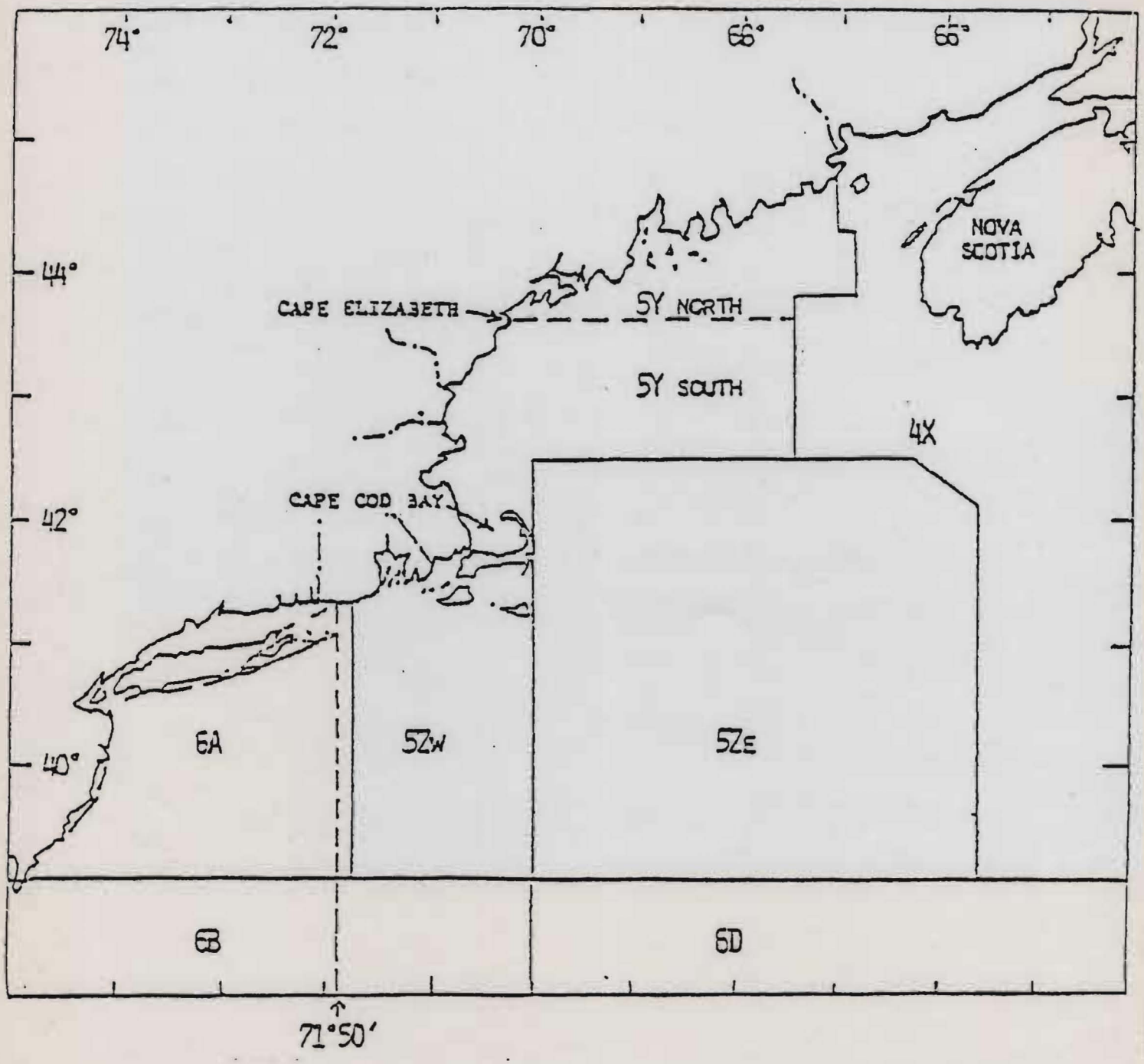
[1]New England Fishery Management Council and National Marine Fisheries Service, Final Environmental Impact Statement/Fishery Management Plan for the Atlantic Herring Fishery of the Northwest Atlantic (Peabody, Mass.: New England Fishery Management Council, 1978), p. A1-1.

[2]Ibid. [3]Ibid., p. 1-4.

Figure 1. Fishery Management Areas



SOURCE: New England Fishery Management Council, Final Supplement to Environmental Impact Statement, Amended and Regulatory Analysis for Atlantic Herring Fishery Management Plan (Peabody, Ma.: New England Fishery Management Council, 1979) p.7.

interactions. Therefore, due to these expected seasonal stock interactions this study will present an overview of all herring stocks within U.S. jurisdiction.

The dense herring schools support two separate fisheries: the juvenile and the adult herring fisheries. The juvenile fishery is directed towards the harvesting of 1-3 year old herring. The harvest impacts upon the Gulf of Maine herring stock. Because the fishery exists in Maine State waters (0-3 miles offshore) it comes under Maine jurisdiction and management. The Maine sardine canning industry is the major market for juvenile harvests. The fishery began with the development of this canning industry in eastern Maine during the 1870's.[1]

At about this same time, the lobster industry began to expand, creating a market for the larger, unwanted adult herring (age 3+ herring) to be used as bait.[2] For the next century the adult herring fishery was a very low-priced fishery. The adult herring, if it was not used as lobster or codfish bait, mostly went to the fish reduction plants to be reduced to fish meal and fish oil with only a minor quantity being used for smoking and salting.[3] The quality of the landed adult herring was of no real significance. Therefore, no measures were developed to preserve the quality while the herring was on board the fishing vessel.

During the late 1960's and early 1970's two developments occured that dramatically changed the domestic herring fishery. First, the availability of juvenile herring decreased and, thereby, forced the canneries to use larger fish and to develop economical ways of using them.[4] Second, the Northeast Atlantic herring stock declined, producing

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[1]Ibid., p. A2-10. [2]Ibid. [3]Ibid. [4]Ibid. p. A2-71.

a herring shortage in the West German (Federal Republic of Germany) herring import market.[1] Within a very short time period, adult herring was in demand. This adult herring is now being filleted and frozen for shipment to European market (primarily, West Germany).[2] The herring export market will be examined further in Chapter I.

The filleting and freezing of adult herring began in Gloucester, Mass. in June 1970 with the operation of 10 fillet machines in one plant.[3] By fall of 1977 the herring filleting industry had expanded to 5 plants with over 40 filleting machines.[4] Four of the five herring plants currently in operation are located in Maine; the remaining one is the Gloucester plant.[5] The Gloucester plant is experiencing community and environmental problems with its operations in that city.[6] The plant, presently, is unable to handle all the herring landed seasonally in Gloucester. Part of the landings are being trucked to herring processing plants in Maine.[7]

The adult herring processing industry in New England consists of specialized machines from Baader and Arenco.[8] These machines have the capacity to remove heads, tails, viscera and backbones at a rate of 100 fish per minute.[9] The offal is reduced to fish meal and fish oil.

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[1]Ibid., p.A2-74.

[2]Lars Olaf Vidaeus, "Analysis of Foreign Demand for U.S. Fish Stocks Under Extended U.S. Fisheries Jurisdiction with an Application to the New England Herring Resources." (Ph.D. dissertation, University of Rhode Island, 1977), p.

[3]Management Council, Herring Management Plan, p.A2-91.

[4]Ibid. [5]Ibid.

[6]Ed McLeod, Lipman Marine Corporation, Gloucester, Ma., personal communication, 1978.

[7]Management Council, Herring Management Plan, p. A2-39.

[8]Ibid., p.A2-93. [9]Ibid.

The finished herring product is packed in 30 pound cartons, plate frozen, stored and shipped.[1]

The adult herring that is processed in these plants as supplied by domestic fishermen is harvested almost totally off the coasts of Mass. and Maine and to some extent R.I.. In 1976, about 7,6000 MT were caught in the adult herring fishery off the Maine coast (in Stat. areas 511-513, see Figure 2) and 11,500 MT were caught in Massachusetts Bay and Cape Cod Bay (Stat. area 514).[2] However, the R.I. catch only amounted to 150 MT for 1976.[3] These harvests were mostly made near shore from the Gulf of Maine stock. The area east of Cape Cod (Stat. area 520-526) has to date been insignificant as a herring fishing area for domestic vessels. In 1976, the domestic catch from this area (all from Stat. area 521, Nantucket Shoals) only amounted to 500 MT, or 3 percent of the entire domestic catch of adult herring.[4] Hardly, any of these harvests were from the Georges Bank stock. Some may have been harvested at certain times of the year due to some stock interaction. The potential of the Georges Bank stock will be detailed in a following section.

The food herring market is directed towards a variety of herring products. These products consist of canned, marinated, smoked, kippered, salted or pickled herring, as well as, frozen headed and gutted (H & G) frozen fillets and frozen whole herring.[5] The processing vessel operation to be analyzed in this study will primarily fillet and freeze the adult herring. There will be some quantities of herring being headed and gutted and frozen along with some herring being frozen in whole

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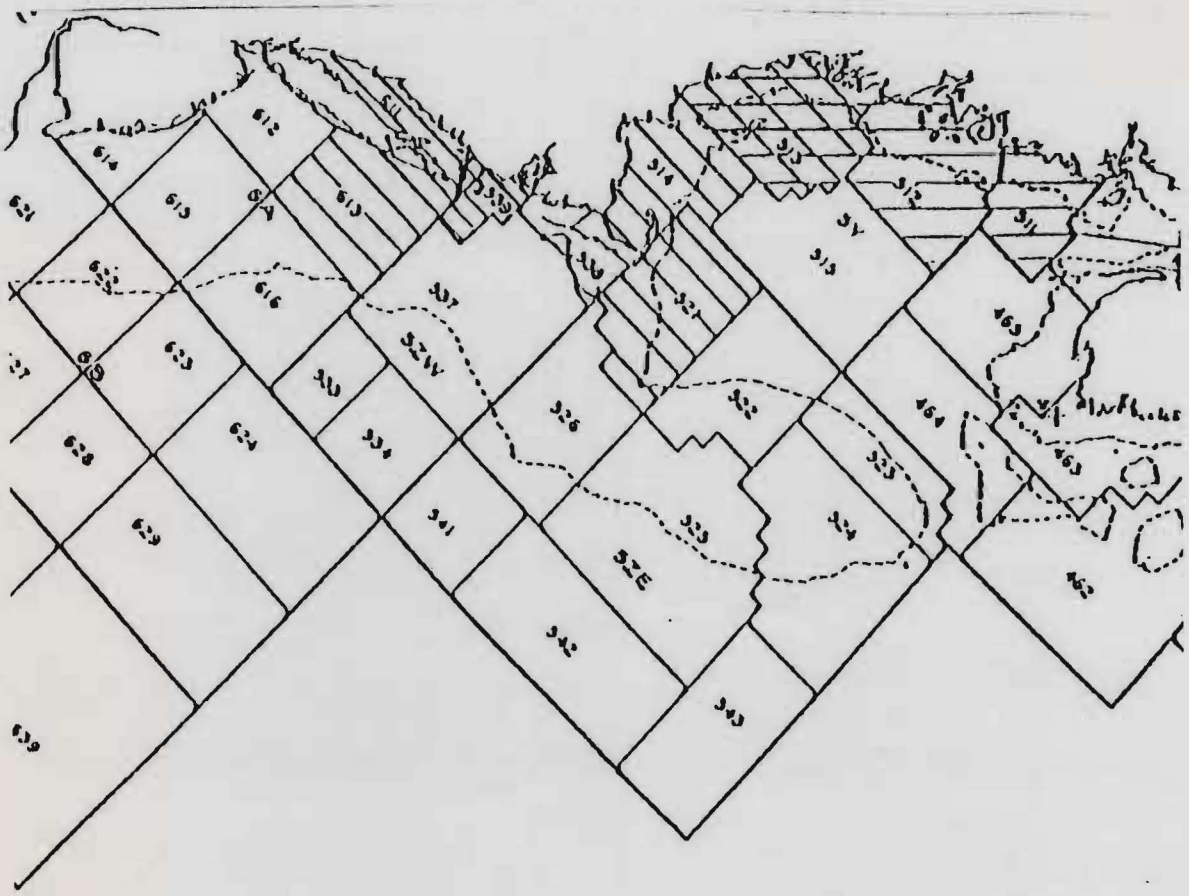
[1]Ibid. [2]Ibid., p.A2-32. [3]Ibid. [4]Ibid. [5]Ibid., p.A2-93.

Figure 2. Statistical Areas



SOURCE: New England Fishery Management Council and National Marine Fisheries Service, Final Environmental Impact Statement/ Fishery Management Plan for the Atlantic Herring Fishery of the Northwest Atlantic (Peabody, Ma.: New England Fishery Management Council, 1979) p. A2-33.

/// Juvenile Fishery

Juvenile and Adult Fishery

Adult Fishery

form. The larger herring will be filleted, whereas, the smaller herring will only be headed and gutted or frozen whole. (Adult herring, age three and older, are defined for industry guidance purposes as being 9 inches or greater total natural length.[1]

Development of Domestic Fishery

Figure 3 and Table 1 shows how the ex-vessel price paid for adult herring has increased from 1965 to 1978. Prior to 1970 the bulk of the adult herring catch was of very low value because of its destination to fish meal plants.[2] However, with the expansion and development of a herring fillet market in West Germany, the ex-vessel price for adult herring has been steadily increasing.[3] If it were not for this export market potential coupled with a needed supply for existing canneries the domestic adult herring fishery would not have expanded. However, most of this added effort has been exerted relatively near shore: on the Gulf of Maine stock, primarily, and to a lesser extent on the Georges Bank/Southern New England stock.

As more herring processing plants opened in Maine during the seventies, the ex-vessel price for adult herring correspondingly increased (see Figure 3). During the infancy of the adult herring processing industry, about 1970, the catch rate of juvenile herring had already started to decline. This decline in the availability of the juvenile herring coupled with the transfer of harvesting effort from the juvenile landings from 1968 to 1970 and the corresponding sharp

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[1]Management Council, Supplement to Herring Plan, p.8.

[2]Management Council, Herring Management Plan, p.A2-57.

[3]Ibid.

Fig. 3. Domestic Landings and Prices

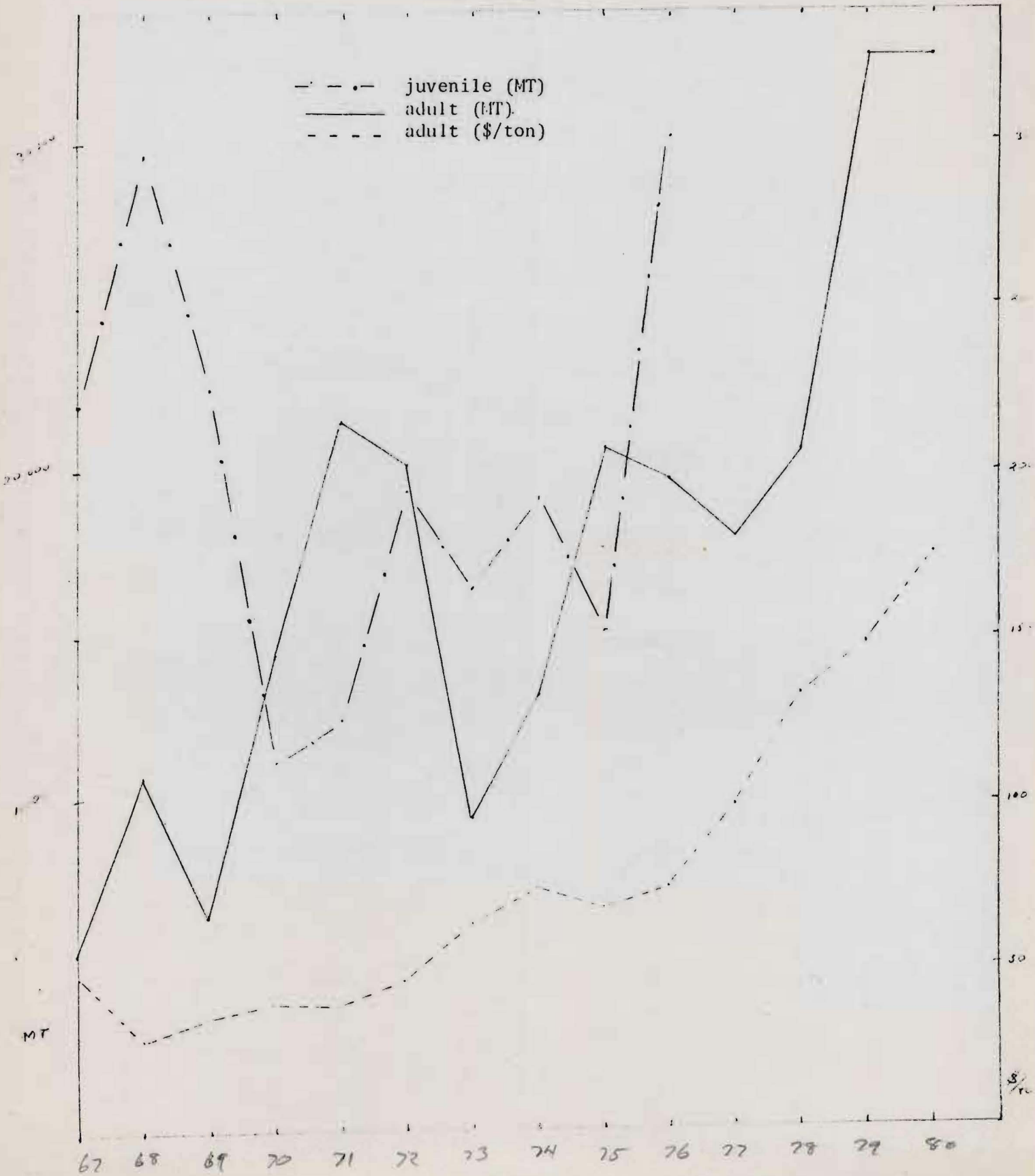

TABLE 1

HERRING LANDINGS

	Adult		Juvenile
	MT	$/ton	MT
1967	5,423	49	21,451
1968	10,798	27	29,891
1969	6,518	33	22,659
1970	14,348	38	11,119
1971	21,520	38	12,408
1972	20,249	45	19,498
1973	9,599	63	16,400
1974	13,246	73	19,142
1975	20,812	67	15,182
1976	19,870	73	30,195
1977	17,978	97	—
1978	20,656	132	—
1979	32,530*	146*	—
1980	32,530*	174*	

SOURCES: Management Council, Herring Management Plan, p. A 2-17 and p. A2-94.

*Figures are projected in the Supplement to Herring Plan, appendix 5.

increase of adult landings from 1969 to 1971. Even though the ex-vessel price of adult herring rose only slightly, fishermen landed record amounts of adult herring.

As a market developed for the adult herring the fishermen landed increasing amounts of adult herring. There was no problem with the supply but rather with the previous limited market for the adult herring that had existed. The ex-vessel price per ton for adult herring was not actually a major factor for the increase in landings. As can be seen in Figure 3, the ex-vessel price remained relatively constant between 1969 and 1971, whereas the landings increased about 230% for this same period. The adult fishery has for the most part been a response or alternative to the juvenile fishery.

This new market potential along with the corresponding increases in ex-vessel prices for the adult herring has created new opportunities in the harvesting sector. Purse seining and pair trawling are the principal fishing methods used for harvesting adult herring. Immediately prior to and during the spawning period, herring congregate in dense schools making them economically feasible to purse seiners.[1] This occurs during the summer/fall fishery (July-Nov.) At these times the purse seiners dominate the harvesting of herring. It is expected by the Council that in 1978/79 that the purse seiners will have harvested 94% of the domestic adult herring landings from July to Nov.[2]

During the winter/spring fishery, however, the situation reverses. The herring are more dispersed and are typically more available to trawl gear.[3] The Council predicts in 1978/79 that pair trawlers will have harvested 80% of the adult herring landed during this period, Dec.-June.[4]

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[1]Ibid., p. A2-69. [2]Ibid., p.A2-70. [3]Ibid. [4]Ibid.

Fishermen have entered the adult herring fishery because they have been attracted by the high catch rates, the increasing ex-vessel prices and the profitable foreign markets.[1] The "traditional" fisheries of the New England area (cod, haddock and flounder) are being saddled by many restrictions, regulations and quotas imposed by the New England Fishery Management Council. The fishermen are being forced out of these "traditional" fisheries either economically, psychologically and/or philosophically. In this respect fishermen view the adult herring fishery as growing in importance by providing economic well-being.[2] Many will fish adult herring using slack time from other directed fisheries.[3] This slack time can run anywhere between 3 months and 9 months each year.[4] The slow herring period is the summer months of June, July and August.[5]

In 1976 (the latest figures available) there were 33 vessels in the New England directed adult herring fishery.[6] Twenty-six of these vessels entered the adult herring fishery within the previous ten years.[7] A participant in the directed adult fishery is considered to be a vessel, which lands at least 50% of its catch as adult herring on a trip when adult herring has been caught. In 1976, these 33 vessels had a combined catch of 18,100 MT of adult herring accounting for 98% of the total New England adult herring catch for that year. However in the same year there were 113 vessels that landed any adult herring either from a directed fishing effort or as an incidental catch while fishing

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[1]Ibid., p.A2-29. [2]Ibid., p.A2-30. [3]Ibid.

[4]Ibid., p.A2-29

[5]New England Fishery Management Council, personal communication, 1979.

[6]Management Council, Herring Management Plan, p.A2-28.

[7]Ibid., p.A2-29.

for other species.[1] As explained above, these vessels were primarily harvesting adult herring from the Gulf of Maine stock near to the coasts of Maine and Massachusetts.

Objective of the Herring Fishery Management Plan

The overall intent of the Council is to slow down and stablize the harvest of adult herring from the Gulf of Maine stock and to begin rebuilding that stock, without detrimentally affecting or causing undue hardship for either the purse seiners or pair trawlers in area 5Y.[2] The Council extends all possible encouragement towards the development of a fall adult herring fishery on Georges Bank, area 5Z.[3] Even though the Council has increased the overall OY for the Gulf of Maine stock from the previous year of 1978/79, they still prefer transfer of effort onto the Georges Bank stock. The recommended level of catch from the Georges Bank stock may be significantly increased in future years if given evidence of successful recruitment.[4]

"An important limitation of the U.S. herring fishery lies in its inability to harvest the offshore stocks, because the herring deteriorated quickly and U.S. vessels have not been equipped to prevent spoilage."[5] Even though domestic fishermen have dramatically increased their harvests of adult herring, this effort has been exerted relatively near shore, primarily upon the Gulf of Maine stock. When the adult

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[1]Ibid., p.A2-21.

[2]Management Council, Herring Management Plan, p.ii.

[3]Ibid., p.9.

[4]Idem, Supplement to Management Plan, p.8.

[5]Vidaeus, Foreign Demand, p.51.

herring was only used for reduction purpose and/or for lobster bait the quality was of very little significance. However, now that the adult herring is being processed for human consumption the processors are demanding a high-quality fish. To provide the high-quality fish, herring fisherman have to fish within 6-10 hours of port.[1]

The deterioration problems experienced with herring is the major reason why the U.S. has never developed a herring fishery on Georges Bank. U.S. vessels are still not fully capable of fishing in the distant waters of Georges Bank (area 5Ze). This is primarily due to two reasons: 1.) the vessels do not have adquate refrigration systems, and 2.) current herring vessels are not large enough.[2]

Herring does not keep well in ice alone, the most common method of preserving fish on board vessels. The herring vessels need either refrigerated sea water (RSW) or chilled sea water (CSW) to reduce the bacterial deterioration of the herring. However, fat oxidation (rancidity) is another major concern for herring harvested offshore. RSW and CSW will not diminish the fat oxidation very much.[3] RSW and CSW are expensive to install on vessels. Still after the expenditure for such capital improvements on the vessels the overall quality of the herring landed still may not be of acceptable quality due to the fat oxidation problems.

The current herring vessels operating nearshore are all less than 150 gross tons.[4] These vessels are not totally capable of safely

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[1]Robert Taber, commercial fisherman, Wakefield, R.I., personal communication, 1979.

[2]Vidaeus, Foreign Demand, p.51.

[3]Jan Johnson, class notes of FMT 518, University of Rhode Island, 1977.

[4]Vidaeus, Foreign Demand, p.51.

venturing to Georges Bank to fish for adult herring while it spawns in dense schools on the eastern part of the Bank during the period August to October.[1] In addition to the safety considerations these vessels can not physically transport enough of this 8-10¢/bl. herring back to port to justify the time and costs involved with a trip to Georges Bank. The vessels in New England that are capable of fishing for this adult herring have traditionally been used for groundfish.[2] These larger groundfish vessels could do the fishing as an alternative to the excess capacity experienced in the groundfish fisheries and to the myriad regulations presently involved with the groundfish fisheries. However, they would still be faced with the quality-control problems associated with the herring by the time they returned to port.

In order to utilize the Georges Bank adult herring stock more effectively and to provide for transfer of effort out of both the 5Y adult herring fishery and the groundfish fisheries a method needs to be developed to provide for the alleviation of the deterioration problems. The proposed operation of a processing vessel in the adult herring fishery will be able alleviate these quality problems. The vessel will provide an offshore market for the Georges Bank herring, thereby, providing encouragement for increased explotation of this stock. Harvesting vessels will be able to maintain a directed Georges Bank herring fishery or be able to fish the herring as a alternative from other fisheries.

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[1]Ibid. [2]Ibid.

Supplement to Herring Management Plan

In September 1979 the Council issued an amendment to the herring management plan. This amendment, among other things, "... establishes a new OY for the Gulf of Maine and Georges Bank and South areas including an allocation of 2,000 MT to Canada from Georges Bank."[1] (see Figure 4). This allocation to Canada from Georges Bank is in accordance with the Treaties between the U.S. and Canada from Georges Bank in regards to fishing and boundary disputes on Georges Bank. The treaties are subject to ratification in the U.S. Senate.

Total removals of adult herring (age 3 and older) from area 5Y (Gulf of Maine) have, over the past decade, averaged about 30,000 MT.[2] On the basis of historical catch rates, the historical relationship to the entire herring resource, and, based upon proportional removal from other resource components, the Council has set an OY of 30,000 MT for area 5Y.[3] The expected resource removals from the Georges Bank stock, however, will be well below historic levels--when the foreign fleets were harvesting the herring on Georges Bank. In actual proportions, then, the expected harvest from the Gulf of Maine stock will be greater, in relation to extractions from the entire resources than warranted by historic harvests.

In determining the area/season allocations of this adult herring resource the Council had to consider the projected stock interactions. The area allocations, shown on Figure4, reflect the perceived stock interactions at certain times of the year. The 5Z/SA6 allocations of

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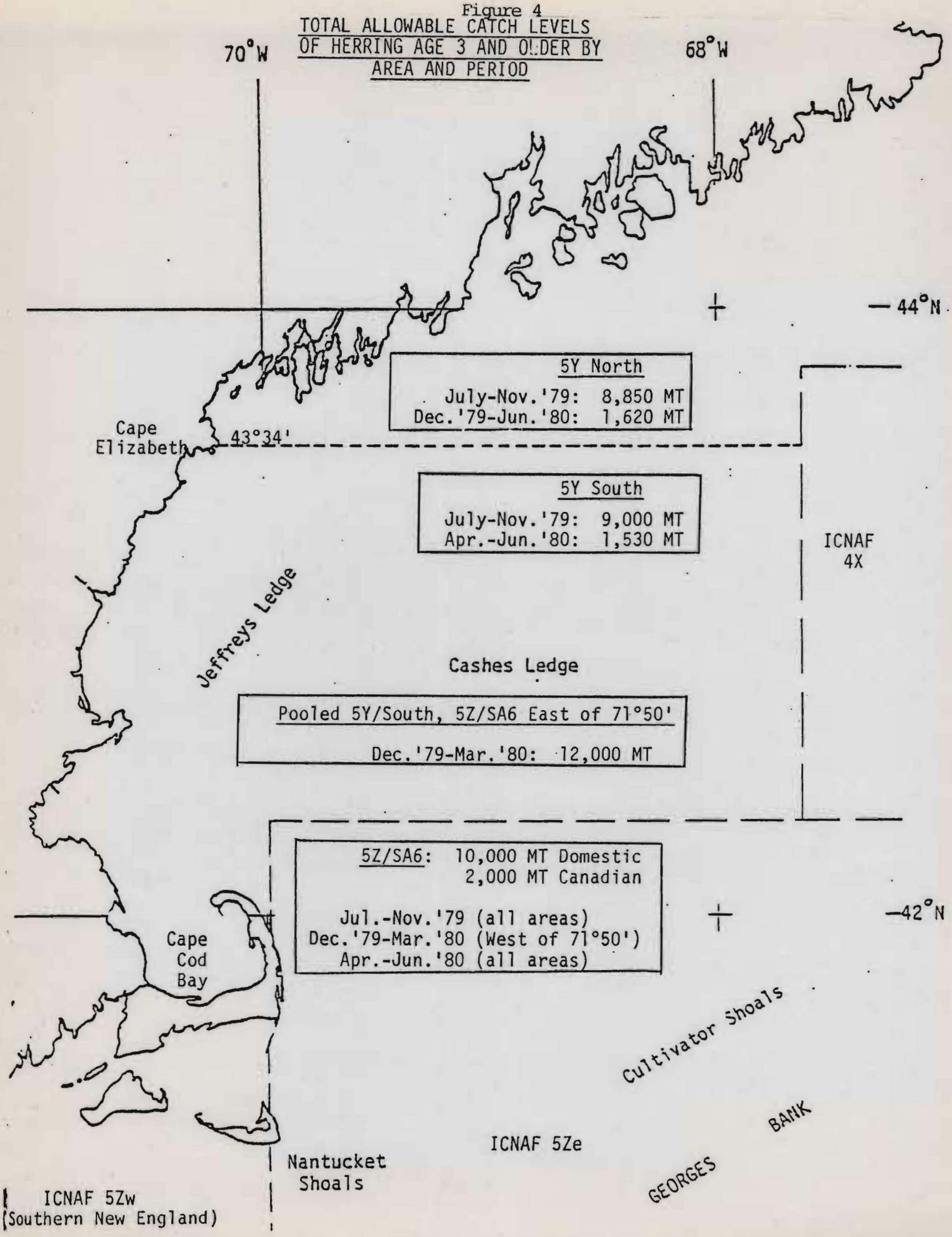
[1]New England Fishery Management Council, Final Supplement to Environmental Impact Statement, Amended and Regulatory Analysis for Atlantic Herring Fishery Management Plan (Peabody, Mass: New England Fishery Management Council, 1979), p.i.

[2]Ibid.,p.2. Ibid., p.5.

Figure 4
TOTAL ALLOWABLE CATCH LEVELS
OF HERRING AGE 3 AND OLDER BY
AREA AND PERIOD



10,000 Mt for domestic fishermen and 2,000 MT for Canadian is expected to draw upon the Georges Bank herring stock during the time-periods projected. However, for the winter R.I. fishery, from Dec. to March, there is an allocation of 3,000 MT for the area 5Z/SA6 east of $71^{0}50'$ longitude. This fishery is expected to draw upon the Gulf of Maine stock. Therefore, this 3,000 MT comes from the "Pooled 5Y/South, 5Z/SA6 East of $71^{0}50'$ Dec. '79 to Mar. '80: 12,000 MT" allocation (see Figure 4).

In summary, therefore, areas 5Z/SA6 will receive a total allocation of 15,000 MT, including the Canadian allocation. However, of that amount, 3,000 Mt in the winter RI. fishery is expected to be herring from the Gulf of Maine stock and the other 12,000 MT is expected to be herring from the Georges Bank herring stock. Given the probable strength of recent recruitment to all resource components, these levels of optimum yield may result in more rapid rebuilding of the Georges Bank stock than the Gulf of Maine stock, since for the Georges Bank stock allowable removals remain limited.[1] The Gulf of Maine stock has a lot of pressure exerted upon it from both the juvenile and the adult fisheries. The Georges Bank stock has had little pressure exerted upon it since the foreign fishing fleets were restricted by the enactment of the FCMA.

Herring Potential

Foreign Fishing for herring off the New England coast dates back to the early 1960's. Vessels from the U.S.S.R. started fishing for herring in the Georges Bank area.[2] During the mid 1960's fishing

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[1]Ibid., p.3. [2]Idem, Herring Management Plan, p.A2-62.

fleets from Poland, East Germany and West Germany joined the Soviets on Georges Bank.[1] These fleets consisted of mid-water trawlers, freezer-trawlers, and large factory ships. There were about 900 to 1,000 foreign vessels annually fishing in the international waters from Nova Scotia to Cape Hatteras during the late 1960's to the early 1970's.[2]

Tables 2 & 3 shows the annual foreign adult herring catch compared to the annual domestic adult herring catch for areas 5Z/SA6 and area 5Y. Figure 5 schematically shows the relationship between the foreign adult herring harvests and the domestic adult herring harvests for 5Z/SA6 and 5Y. As can be seen from these charts the domestic herring harvest has been relatively miniscule in comparison to the foreign herring harvests for the past two decades.

The majority of the foreign harvest come from areas 5Z and SA6. The foreign fleets concentrated their effort on Georges Bank (5Ze) during the fall spawning season.[3] In 1975 alone, 99% of the foreign harvest was taken from area 5Ze.[4]

These foreign fleets only came under catch quotas in 1972. ICNAF imposed individual national quotas from the period 1972 to 1976.[5] The U.S. withdrew from ICNAF at the end of 1976 and began regulating the herring fisheries subsequent to the FCMA enactment on 1 March 1977. Foreign herring fisheries were initially regulated by a Preliminary Management Plan (PMP) prepared by the Dept. of Commerce and issued on the 22 February 1977 in the Federal Register. The PMP only regulated the foreign fishing activities. Under the PMP the foreign adult herring allocation for 1977 was about 20,000 MT of which only about

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[1]Ibid. [2]Ibid., p.A2-67. [3]Ibid. [4]Ibid. [5]Ibid.

TABLE 2

HARVEST OF ADULT HERRING
AREAS 5Z AND SA6
(MT)

	USA	Foreign	Total
1967	1,211	217,532	218,743
1968	758	372,840	373,598
1969	3,678	307,080	310,758
1970	2,011	245,283	247,294
1971	3,822	263,552	267,374
1972	2,782	171,408	174,190
1973	4,627	193,081	197,708
1974	3,385	144,585	147,970
1975	4,582	141,504	146,086
1976	735	41,400	42,135

SOURCE: Management Council, Herring Management Plan, p. A2-65.

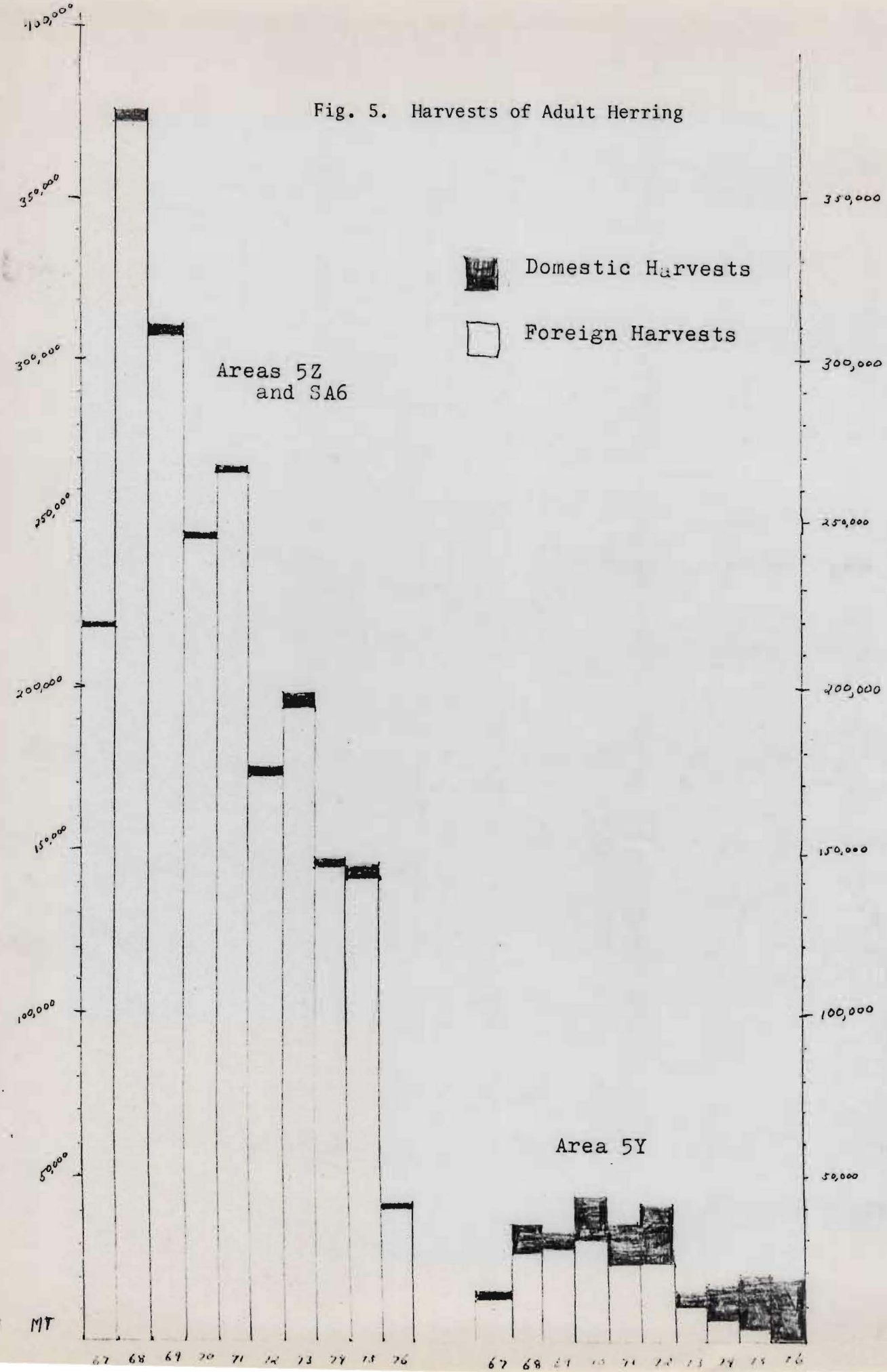
TABLE 3

HARVEST OF ADULT HERRING
AREA 5Y
(MT)

	USA	Foreign	Total
1967	2,581	6,601	16,748
1968	10,403	21,497	37,158
1969	4,834	27,572	33,600
1970	13,564	26,623	44,684
1971	19,077	19,498	38,575
1972	18,698	24,220	42,918
1973	5,201	11,658	16,859
1974	10,233	7,786	18,019
1975	16,864	4,666	21,530
1976	19,204	1,000	20,204

SOURCE: Management Council, Herring Management Plan, p. A2-66.

Fig. 5. Harvests of Adult Herring



1,600 MT were actually harvested.[1] The herring fisheries management plan (FMP), prepared by the regional management council, took effect in August of 1978. The FMP regulates both the foreign fishing fleets and the domestic fishing fleet.

The Council, by means of the herring FMP, has established an OY of 12,000 MT for the Georges Bank herring stock. In relation to the amount of herring that the foreign fleets were able to harvest for the decade prior to the FCMA enactment (average of 224,000 MT per year, see Figure 5), this present OY appears to be greatly undercalculated. Thus herring stocks may legitimately be extremely low due to the large foreign harvests. However, the U.S. alternatively could be preserving this stock for the expected U.S. expansion into the Georges Bank herring fishery. If the Council-determined OY for the herring stock equals the estimated domestic catch (EDC) there is no surplus and consequently no allowable level of foreign fishing for herring. The result is that American fishermen do not have to compete with any foreign fishing fleets while expanding and developing a domestic Georges Bank adult herring fishery. This expansion of effort by American fishermen can parallel the recovery and rebuilding of the herring stock. Lars Vidaeus, a former staff economist for the Council, has stated in relation to the Georges Bank herring stock that:

> "... the present management strategy aims at rebuilding the stock to a level which would permit an estimated MSY of 120,000 tons per year. With good recruitment equal to the average annual level of the past eleven years the desired stock size may be reached relatively soon."[2]

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[1] NMFS, Fisheries 1977, p. xiii.

[2] Vidaeus, Foreign Demand, p.53.

CHAPTER II

PRODUCTION OF AND MARKETS FOR DOMESTIC ADULT HERRING

Domestic Production

The filleting and freezing of adult herring in New England is directly aimed at providing a raw material input to the West German herring processing industry.[1] There has been a continued market expansion along with price increases in West Germany for frozen herring fillets. This increase in demand for U.S. herring fillets in the West German market has stimulated U.S. production of fillets and has created U.S. interest in the adult herring in areas 5Z and SA6.[2]

The expansion of both the U.S. processing and harvesting sectors has followed the climb of CIF prices for herring fillets in West Germany.[3] (CIF is the acronym for Cost, Insurance, and Freight. This terminology refers to the pricing arrangement between the exporter and the importer such that the exporter assumes responsibility for shipping and associated charges to deliver the product at the importer's port.) Table 4 and Figure 6 detail the sharply increasing U.S. production of frozen fillets and the value per ton of these fillets both at the U.S. plant and at the West German port. As can be seen from the Table and

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[1]Management Council, Herring Management Plan, p.A2-91.

[2]Idem, Supplement to Herring Plan, p.16.

[3]Idem, Herring Management Plan, p.A2-106.

TABLE 4

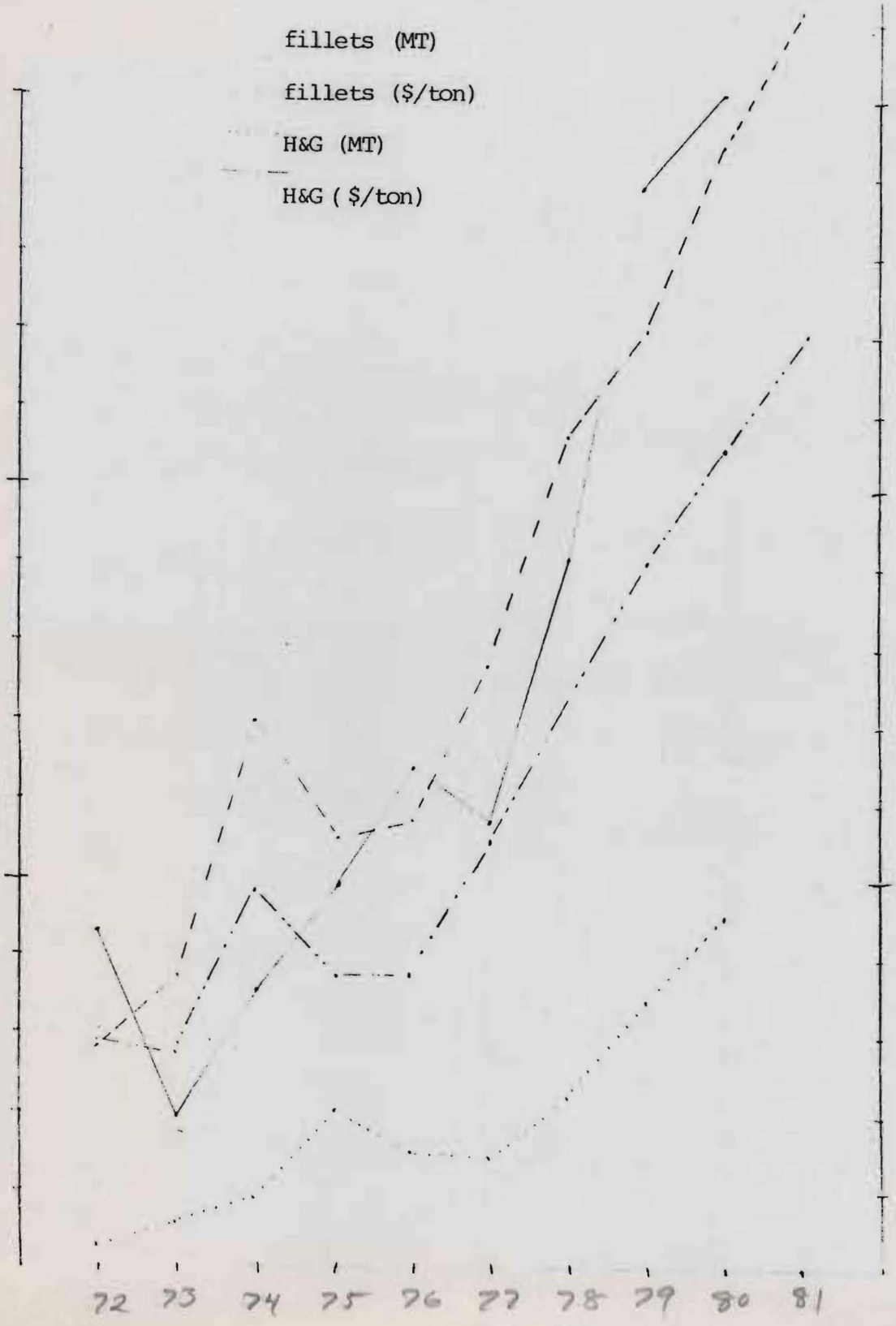
DOMESTIC PRODUCTION OF AND PRICES FOR HERRING FILLETS AND H&Gs

	H&G		Fillets	
	MT	$/ton	MT	$/ton
1972	359.2	287	4,355.6	284
1973	561.4	276	1,896.6	375
1974	938.9	485	3,583.4	701
1975	2,075	375	4,969.8	551
1976	1,525.5	374	6,429.3	575
1977	1,435	551	5,741.1	771
1978	2,286	640	9,147.2	1,068
1979	3,465	904	13,860*	1,235*
1980	4,514	1,050	15,058*	1,440*

Sources: Management Council, Herring Management Plan, p.A2-92,; idem, Supplement to Herring Plan, appendix.; and NMFS, Fisheries of U.S. 1978.

*Figures are projected by Management Council in Supplement to Herring Plan.

Fig. 6. Domestic Production of and Prices for Herring Fillets and H&Gs



Figure, the U.S. production of herring fillets in response to the continued increases in foreign demand has jumped from 1896 MT in 1973 to 9,147 MT in 1978--equivalent to an increase of 382% in 5 years. The Council has estimated that U.S. production of fillets will increase to 13,860 MT in 1979 and to 15,058 MT in 1980.[1] The 1980 projected figures represents an increase of 64% in 2 years from the 1978 production level. The Council has also projected that the CIF prices at West German ports will increase to $1,569 per ton in 1980 an increase of 159% in 5 years.[2]

For the period 1972 to 1976 there has been an average of 4 times as many herring fillets produced than H & G herring (see Table 4). Based upon the 4:1 ratio and the fact that H & G figures were only available until 1976, this study has projected the amount of H & G production for the years 1977 to 1980. The prices for H & G herring were available up to 1977 and for 1979. These prices are listed in Table 4 and on Figure 6. The 1980 and 1981 prices are projected from the recent trend in the H & G prices. These prices have generally paralleled the rising fillet prices.

Data for frozen whole herring are only available for a few years. In 1976, 2,800 MT of herring were frozen in whole form for further processing in West Germany.[3] The averaged CIF price fo the period

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[1]Idem, Supplement to Herring Plan, appendix 5.

[2]The Management Council has used both the CIF prices and the U.S. plant prices from NMFS in the determination of the management regime for the herring fishery. This study, though, will use the data from NMFS for the prices per ton quoted at the U.S. processing plants. These prices will generally average about $100 to $200 per ton less than the CIF prices in West Germany. Lars Vidaeus, staff economist, New England Fishery Management Council, Peabody, Ma., personal communication, 1978.

[3]Management Council, Herring Management Plan, p.A2-91.

1972 to 1976 for frozen whole herring was $319 per ton, however, the CIF price in 1976 was only $284 per ton.[1] The price in 1977 was back up to $330/ton.[2] The frozen whole herring price has averaged about 3.5 times the ex-vessel price paid to fishermen for whole herring (see Table 1). The most recent 1980 price for frozen whole herring is the CIF price in West Germany of $926 per ton.[3]

These prices are somewhat spotty and, therefore, a projection for domestic frozen whole herring prices for 1980 to 1981 is tenuous. However assuming shipping charges of $150-200 per ton to West Germany, assuming that frozen whole prices parallel the rising ex-vessel prices, and assuming averages for the full year this study will use frozen whole prices of $600 per ton and $750 per ton for the years 1980 and 1981, respectively.

Fish meal and fish oil are two important industrial products of herring processing. Table 5 and Figure 7 list the herring fish meal and fish oil production and prices from 1971 to 1978. Figure 7 lists the prices for the fish meal and oil for the period and then are projected for 1980 and 1981. The April 1980 price for fish meal is a little under $400/MT, while the fish oil price is slightly higher at about $500/MT.[4] The prices for 1981 are projected on Figure 7 to be $420/MT and $520/MT for fish meal and fish oil, respectively.

For the purposes of its calculations and figures, the Council

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[1]Ibid., p.A2-107.

[2]NMFS, Market News Division, Gloucester, Ma., personal communication, 1980.

[3]Ibid.

[4]Ed McLeod, personal communications, 1980.

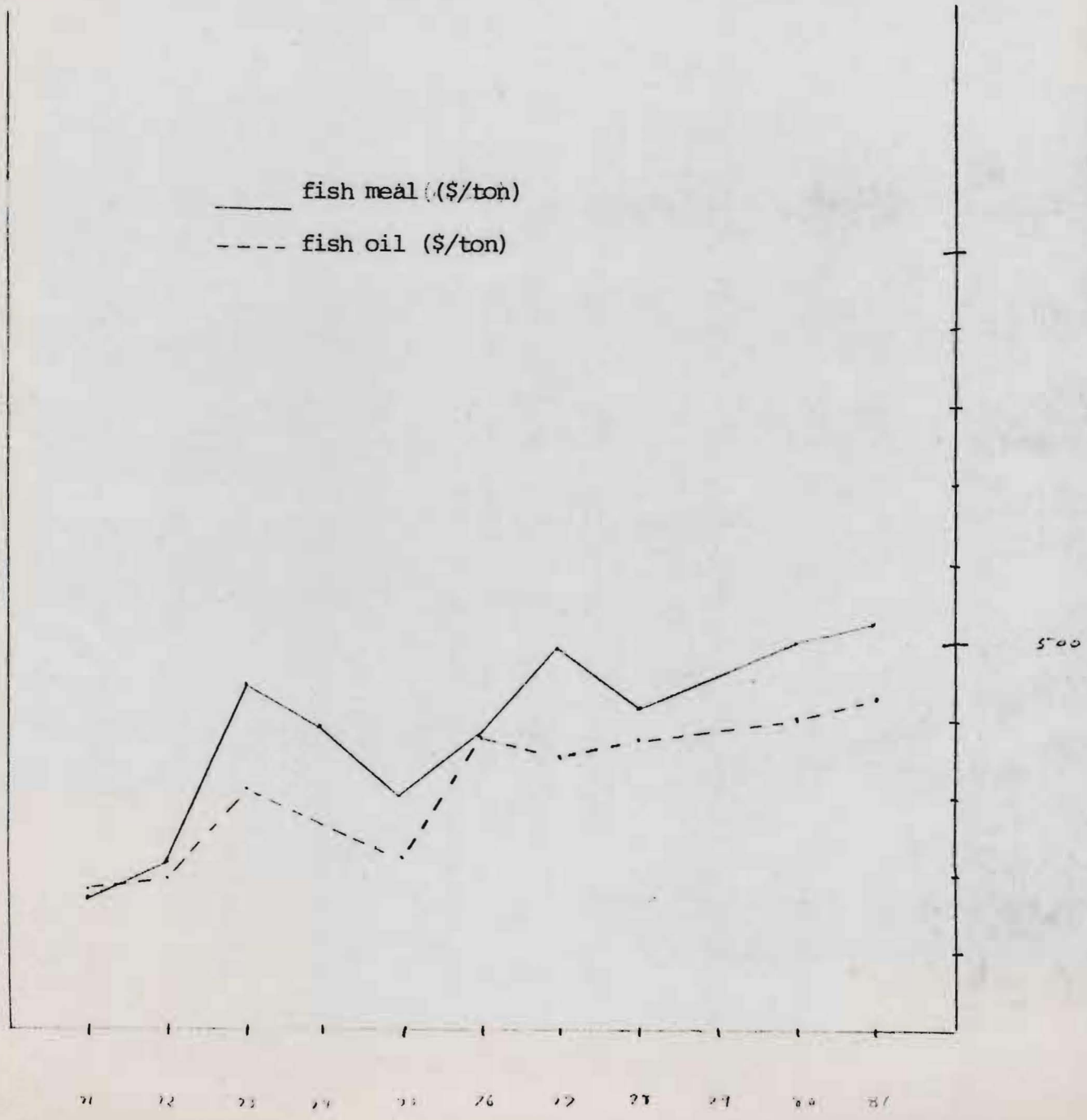
TABLE 5

FISH MEAL AND FISH OIL
PRODUCTION

	MT	$/ton	MT	$/ton
1971	5,189	165	5,856	176
1972	5,487	211	5,064	198
1973	4,457	443	1,724	309
1974	3,191	397	--	--
1975	3,581	299	1,598	220
1976	4,338	373	2,075	375
1977	2,294	350	440	485
1978	--	374	--	418

SOURCES: U.S. Department of Commerce, National Marine Fisheries Service, Industrial Fishery Products, Annual Summary 1977, Current Fisheries Statistics No. 7502 (Washington, D.C.: Government Printing Office, 1979) p. 21.; and Idem, Fisheries of the U.S. 1978, Current Fisheries Statistics No. 7800 (Washington, D.C.: Government Printing Office, 1979) p. 52 . and p. 53.

Fig. 7. Domestic Production of Fish Meal and Fish Oil



estimates that the average yield on herring is about 40% by weight.[1] By combining that yield with the overall catch data in Table 4 along with the H & G production, a yield of 60% by weight for H & G herring is derived. The yield is 100% for the frozen whole herring. Fish meal and fish oil have yields of 17% to 20% and 10% by weight, respectively.[2] This study will use a yield of 19% for the fish meal. The fish meal and fish oil are principally derived from the offal (waste), however, some smaller or damaged fish and other species may also be included at times.

For the data that are available for U.S. adult herring production the ratios between the various major products are listed in Table 6. These figures do not represent yield figures. These percents relate to the amount by weight of the initial ex-vessel herring that actually results in each of these products. These percents and ratios are based upon the New England adult herring processing industry's average production for the past several years. This study will base the expected production on board the processing vessel upon these industry ratios. By using these ratios this study will be able to calculate how much of each product will be produced by the processing vessel for a certain amount of raw adult herring supplied to the vessel. These results will be multiplied by the projected prices for each product for the years 1980 and 1981. The 50% offal figure in Table 6 represents that amount of the initial herring that is available for the reduction to fish meal and fish oil.

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[1]Management Council, Supplement to Herring Plan, appendix 5.

[2]Ed McLeod, personal communication, 1980.

TABLE 6

PERCENT PRODUCTION FROM RAW MATERIAL

30%	frozen fillets
7%	frozen H&G's
13%	frozen whole
50%	offal for reduction
100%	total

West German Market

The bulk of the internationally traded food herring takes the fresh and frozen whole, headed & gutted or fillet form. The market revolves around the need of the West German herring processing industry to supplement their domestic supplies of fresh and frozen herring.[1] In 1977/78 there was nearly no deep frozen herring production at all by the West German fleets.[2] Prices have been continually escalating due to the catch limitations in the North Sea and other ocean areas.[3] Therefore, the West German processing industry began relying more and more upon imported herring to satisfy their needs. These imports were both in a raw unprocessed form (e.g. whole frozen) or in more processed forms (e.g. fillets).

West Germany is the world's largest importer of fish meal. This is primarily due to the continuous trend of German companies to diminish their production capacities for fish meal due to the decrease in the raw material supply by the West German fishing fleet.

Essentially all of the adult herring production in the U.S. is exported to West Germany.[4] The dramatic increase in demand for U.S. herring fillets in West Germany has resulted in a dramatic increase of U.S. production of herring fillets.[5] Table 4 and Figure 6 exhibit this rapid increase of U.S. production for both frozen fillets and frozen H & G's. It is anticipated that the production of herring

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[1]Management Council, Herring Management Plan, p.A2-103.

[2]Federal Ministry of Food, Agriculture and Forestry, Jahresbericht uber die Deutsche Fischwirtschaft 1977/78 (Annual Report on German Fisheries 1977/78) (West Germany: Federal Statistical Office, 1978), p.32.

[3]Ibid., p.48. [4]Idem, Supplement to Herring Plan, p. 16. [5]Ibid.

products from this processing vessel will be directed into the West German market.

The acute demand by West Germany for the raw herring made them willing to pay $160-$175 per ton "as-is, where-is" in 1976/77 for herring allocated on Georges Bank.[1] American fishermen at that time were only receiving $70-$100 per ton for herring landed at port. (see Figure 2)[2] The $160 per ton price, however, was only 8% of the price for processed herring in the West German retail markets, i.e. $2,000 per ton.[3]

The average annual consumption of food herring (1964-1973) in West Germany amounts to 250,000 MT, whereas, the total West European average annual consumption amounts to 6000,000 MT.[4] It is estimated that half of the North Sea landings of herring in the West European market were used for reduction to fish meal and fish oil.[5] However, in comparison to the data in Table 6 the West European percent of the herring supply for reduction to fish meal and fish oil is the same as the percent of the American herring supply for reduction to fish meal and fish oil. The overall production ratios and yields in Western Europe essentially equal the overall production ratios and yields in the U.S.

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[1]Lars Vidaeus, personal communication, 1979. [2]Ibid.

[3]Management Council, Herring Management Plan, p.A2-103.

[4]Ibid., p.A2-103. [5]Ibid., p.A2-98.

Domestic Processing and Harvesting Sectors

The herring processing industry is very seasonal. Employment opportunities peak during the winter/spring herring fishery and again during the summer/fall fishery.[1] The winter/spring fishery is supplied by Rhode Island and Maine pair trawlers whereas the summer/fall fishery is supplied mostly by purse seiners from Massachusetts and Maine.[2] Of the 550 persons seasonally employed in the New England herring fishery, 145 were fishermen directly involved in the fishing operation.[3] In Gloucester alone, the winter herring fishery provides imployment for 100 people who were either unemployed, underemployed or in another fishery.[4] The continued market expansion in West German and the subsequent favorable export market for the U.S. has driven up U.S. production of fillets and will stimulate U.S. fishing in 5Ze and SA6.[5]

In order to harvest enough adult herring for the increased domestic production to satisfy the West German desire for herring the domestic harvesting effort needs to be redirected to fish for adult herring in area 5Ze (the Georges Bank stock). The U.S. fishing fleet with its excess capacity in the groundfish fisheries is capable of harvesting adult herring in 5Z and SA6 since they can easily shift target species to adult herring.[6] However, with the present refrigeration systems on board their vessels the landed herring would not be of acceptable quality for human consumption. The U.S. is capable of harvesting more adult herring but cannot provide the required quality because the processors are too far away from where the fish will be caught.

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[1]Ibid., p.A2-29. [2]Ibid. [3]Ibid. [4]Ibid., p.A2-30.

[5]Idem, Supplement to Herring Plan, p.16. [6]Ibid.

Fuel is becoming a very significant cost to fishermen. Fishermen have to make their trips more fuel efficient, in terms, of steaming time, value of catch and the actual catch rates for the fish. Adult herring can produce very high catch rates, thereby, allowing the fishermen to fill the holds of their vessels quickly. However, in relation to such fish as cod, haddock or flounder, herring is a low-priced fish. Therefore, to steam back to port with a load of herring that is quickly deteriorating is not as profitable as with a load of higher-priced fish. The fuel costs each trip would take a large chunk of the gross stock. If the fishing vessel were able to unload its catch at least once a day while at Georges Bank, it could conceivably be able to harvest quite a few full holds of herring per each round trip to Georges Bank. Therefore, the nonproductive time and cost involved with the long steaming time to and from port would be spread over several full holds of fish.

The operation of a herring-processing vessel on Georges Bank would alleviate many problems experienced by the harvesting sector, by providing a ready market for their catch. The operation of a processing vessel would be able to purchase the freshly-caught herring while it was still in top-quality and, consequently, would be able to produce a high-quality product for export. By being available to purchase herring each day the fishermen will be able to unload their vessls often, thereby, essentially increasing the harvesting capacity of their vessels several fold. Fishermen would also be able to reduce their overall fuel consumption due to the decreased amount of steaming time in relation to the fuel consumption and steaming time involved with unloading back in port.

Herring Quality

As detailed previously the operation of a herring processing vessel is advantageous in that a freshly-caught fish is processed and frozen. the high-quality of Georges Bank herring has to be maintained throughout the processing operations. The success or failure of a processing vessel is contingent upon that maintenance of high-quality. The herring importers in Europe demand a top-quality product and with sound processing practices a vessel should be able to produce the quality product that is desired.

Fish frozen whole at-sea immediately after being caught, when thawed on shore, can be used in much the same way as freshly-caught fish on shore.[1] Sea-frozen fish, if properly handled, can be virtually undistinguishable from fresh fish. Actually the quality may be considerably better than fish kept in ice for more than a few days.[2] The proper handling consists of the quick movement of the fish below decks. Once below decks the fish should be constantly sprayed with seawater to keep the fish cool.[3] Not only does the cool seawater retard spoilage, it also washes the fish and stops the blood from clotting.[4]

The processors' demand for herring is differentiated with respect to a number of product characteristics. The most important characteristics are: size, fat content, firmness of fish flesh, and freshness of fish.[5] Obviously the size of the herring is an important consideration. The processing machines can handle fish of a certain size range.

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[1]United Nations, Fisheries and Agricultural Organization, Freezing in Fisheries (FAO Technical Paper no. 167), 1977, p.65

[2]Ibid., p.66. [3]Ibid., p.67. [4]Ibid.

[5]Vidaeus, Foreign Demand, p.83.

Within this size range (a range that most adult herring will be in) the machine will process the same number of fish whether they are at the larger end of the range or at the smaller end. Therefore, if more larger fish go through the machine then there will be more product weight than would be the situation with smaller fish.

Historically, a drop in fat content from 18-14% to 8-9% has typically resulted in a reduction of the export price of some 10%.[1] A further reduction of fat to 3-4% results in a price reduction of 20-30%.[2] the fat content of the herring decreases during the post spawning and winter season at which time the herring is at its leanest of 3-4% fat.[3] During the spring and prior to spawning the fish are termed "Feedy" and the fat content increases to over 20%.[4] The export price is then at its highest.

The processing yield for fillets ~~off~~ from of a pound of raw fish varies inversely to the fat content and consequently the export price. With a lower fat content the yield tends to increase but the export price tends to decrease. If the fat content exceeds 20% the yield decreased from 45-47% down to 30-35% for fillets, but the export price increases.[5] The average yield for fillets is about 40% for a yearly average.[6]

The firmness of the fish flesh is another important consideration of herring processors. Soft, "feedy" fish are more prone to be damaged both during unloading and during cutting.[7] Soft fish can jam the cutting machines, thereby, slowing down operations. Even though, the soft fish has to be handled delicately and the overall yield for the fillets

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[1]Management Council, Herring Management Plan, p.A2-93. [2]Ibid. [3]Ibid. [4]Ibid. [5]Ibid. [6]Idem, Supplement to Herring Plan, p.16. [7]Idem, Herring Management Plan, p.A2-93.

is generally low it receives the highest product price. The firmness of the flesh is also determined to a lesser extent by the freshness of the fish. Fresher fish will generally be firmer.

The freshness of the herring is another factor that processors are very concerned with. As the time between being caught and being processed increases, the quality of the herring decreases. One of the major deteriorating factors, among others, is due to the guts. There are several important reasons why fish should be gutted as soon as possible after they are caught. These reasons include:

> a.) removal of the guts reduces spoilage brought about by the digestive juices in the guts attacking the belly wall;
> b.) efficient gutting also releases the blood from the fish; and
> c.) the liver, which contains a fat that is highly perishable and could become rancid, is removed.[1]

In addition to these reasons, herring is a fatty and oily fish and, therefore, can become rancid very easily. Rancidity is due to fat oxidation. By freezing the fish the frozen water essentially slows the oxygen transfer, thereby, retarding rancidity.[2] The fat oxidation process begins as soon as the fish dies. It is, therefore, imperative to process the fish as quickly as possible.

The export market for herring products is continuing its rapid expansion in size and in volume. The Georges Bank herring stock can provide the raw material input needed by the U.S. processing industry in order to participate in this export herring market, but the supply is too far away from the place of demand. The need and advantage is demonstrated for a herring processing-vessel. However, the question remains whether it is economically feasible to operate an American-flag

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[1]United Nations, Freezing, p.67. [2]Johnson, class notes.

processing-vessel in the Georges Bank herring fishery. The next chapter of this study will examine some of the legal, institutional and economical considerations involved with a fish-processing vessel venture.

CHAPTER III

LEGAL, ECONOMICAL AND INSTITUTIONAL CONSIDERATIONS

Documentation of a Processing Vessel

There are several organizational and legal alternatives through which a person or company could operate a fish-processing vessel within the U.S. fishery conservation zone. This study will assume that the vessel will be under the U.S. flag, thereby, receiving the rights and privileges reserved in the FCMA and amendments for the U.S. processing industry. As the amendment to the FCMA states:

> "The term 'U.S. fish processors' means facilities located within the U.S. for, and vessels of the U.S. used or equipped for, the processing of fish for commercial use or consumption."[1]

To operate a herring processing vessel off of Southern New England in the U.S. fishery conservation Zone (FCZ) a person or company could: a.) purchase an existing foreign-built processing vessel; b.) convert an existing merchant vessel into a processing vessel; and/or c.) have a processing vessel built.

This study will define all vessels as being self-propelled. Non-self propelled vessels or barges do have applications in various parts of the U.S., primarily Alaska. A floating processing barge is very appealing, initially, due to the diminished crewing requirements and

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[1] P.L. 95-354, Sec. 3, 92 Stat. 519 (1978).

the very high processing capacity that can be arranged on board. Recently, West Coast firms have spurred an interest in the operation of processing barges.[1] These barges, however, are intended for use in the Aleutian Islands, in places where there presently are no shoreside facilities.[2] They will be anchored in relatively protected waters. This would not be the situation for an East Coast operation. To operate in the Georges Bank herring fishery, the barge would need to operate in open ocean areas. Open ocean operation of non-self propelled vessels is, however, far too dangerous.[3] Therefore, this study will not go into elaboration on the feasibility of a barge operation due to the dangers involved at the present time.

There are many foreign-built, foreign-flag, fish-processing vessels that are not being fully utilized, due to the worldwide proliferation of 200 mile fisheries zones. These vessels are being restricted in their distant water operations and, therefore, are becoming a burden to their owners. Many of these vessels are being sold at comparatively low prices. According to the shipping laws of the U.S. a foreign-built vessel owned by a citizen of the U.S. is eligible for documentation as a vessel of the U.S. and entitled to a Certificate of Registry.[4] However, the Certificate of Registry would prohibit employment of the vessel in the American fisheries or coastwise trade

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[1]National Fisherman, 1979.

[2]Glen Voakes, Norlympia, Seafoods, Vancouver, British Columbia, personal communication, 1979.

[3]Edward Sanchez, Sanchez Marine Company, New Bedford, Ma., personal communication, 1979.

[4]Rear Admiral Bell, U.S. Coast Guard, Washington, D.C., personal communication, 1978.

of the U.S.[1]

The U.S. maintains a territorial sea of 3 miles. The term "American fisheries" only pertains to the three-mile territorial sea. This term was formulated about the same time that the territorial sea was established.[2] No law since, including the FCMA, has changed the extent of the territorial sea and no law has changed the original definition of "American fisheries". Therefore, American fisheries, as used, still refers to the fishing activities conducted within the territorial sea.

A foreign-built vessel with a Certificate of Registry could take on board outside the three mile limit the catch of vessels legally fishing in the area and process and transport such fish or fish products to the U.S. or elsewhere.[3] Even though, FCMA provides for U.S. management authority over fish out to 200 miles, the policy of the Congress as stated in the FCMA is:

> (1) "to maintain without change the existing territrial or other ocean jurisdiction of the United States for all purposes other than the conservation and management of fishery resources, as provided for in this Act;"
> and
> (2) "to authorize no impediment to, or interference with, recognized legitimate uses of the high seas, except as necessary for the conservation and management of fishery resources, as provided for in this Act."[4]

The FCMA, therefore, does not authorize any impediment or interference with an American-flag processing vessel in the FCZ, even though, it might be foreign-built. This prohibition of interference in the FCZ

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[1]U.S. Department of transportation, U.S. Coast Guard, Documentation and Measurement of Vessels, Federal Register v.34, #245 Part II (Washington, D.C.: Government Printing Office, 1969) Sect. 67.63-9.

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[3]Rear Admiral Bell, personal communication, 1979.

[4]FCMA, Sect. 2, 90 Stat. 333 (1976).

would be effective as long as the processing vessel was not adversely affecting the conservation and management of fishery resources within the FCZ. With a Certificate of Registry a foreign-built vessel would be a vessel of the U.S. for the purposes of the FCMA and, therefore, would be subject to the laws of the U.S. The term "vessel of the U.S." means any vessel documented under the laws of the U.S. or registered under the laws of any State.[1] As a vessel of the U.S. this foreign-built,processing vessel would be also classified as an American fish processor (as defined earlier) and, therefore, in the context of the FCMA it would be granted the rignts and privileges to the same degree as other American fish-processors. With U.S. flag documentation, designation as an American processor and as a vessel of the U.S. this vessel would be entitled to enjoy all the legitimate uses of the high seas.

No foreign-built vessel, however documented or referred to in the FCMA, can participate in the U.S. coastwise trade. Therefore this vessel may not transport any cargo, fish or otherwise, between points in the U.S., including the territrial waters.[2] That is, a foreign-built vessel, even though American-flag, can not receive fish within the 3-mile territorial sea and transport that fish to any other point in the U.S., including the territorial sea. This vessel, however, could receive fish outside the territorial sea and within the FCZ and transport such fish to a point in the U.S. This transportation would essentially be coming into the territorial U.S. from the high seas. Such an operation outside the 3-mile territorial sea would be in conformity

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[1]FCMA: Sect. 3, 90 Stat. 336 (1976).

[2]Thibeau, U.S. Customs Service, Washington, D.C., personal communication, 1979.

with the existing shipping and fishing laws.

Existing merchant vessels, whether U.S.-flag or foreign-flag, can be bought and converted into a processing vessel. A foreign-flag vessel would be in the same classification or category as discussed above. Many existing merchant vessels are sold each year at a wide range of prices.[1] The degree or amount of re-outfitting varies significantly between each vessel. The amount varies inversely to the acquisition cost of the vessel and proportionately to the age of the vessel. There are no legal problems faced through the conversion of a merchant vessel into a processing vessel. However, there have been some stipulations attached to ships from the U.S. Reserve Fleet, as sold through the Maritime Administration.

The General Services Administration (GSA), the Department of Defense (DoD), and the Maritime Administration are the principal agencies engaged in the sale of surplus ships with DoD being the most likely source. Merchant vessels over 1,500 tons are sold by the Maritime Administration for nontransportation purposes, including scrapping.[2] There are no use restrictions on merchant-type vessels under 1,500 tons that DoD and GSA occasionally sell.

Ships over 1,500 tons, sold through the Maritime Administration, are to be used for nontransportation purposes. A buyer of such a vessel can not use or operate the whole of the ship's hull in a manner to transport passengers or cargo.[3] Fish processing, in itself, is not an

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[1]Edward Sanchez, personal communication, 1979.

[2]Paul Goulding, Deputy Administrator, General Services Administration, Washington, D.C., personal communication, 1979.

[3]Foltz, Fleet Disposal Branch, Maritime Administration, Washington, D.C., personal communication, 1980.

engagement in either passenger or cargo transport. However, the transportation of the fish and fish products to any port, U.S. or foreign, would be an engagement in cargo transport.[1] Therefore, to convert a vessel over 1,500 GRT from the U.S. Reserve Fleet into a fish-processing vessel to be able to transport the fish a special Act of Congress would be required to exempt the specific vessel from the above restrictions.[2]

The construction of a new processing vessel in a U.S. shipyard, in terms of legalities, is possibly the least troublesome avenue to follow. It is the most expensive in relation to the above alternatives. The designing flexibility associated with a new vessel, however, could be very advantageous. The vessel could be designed for its processing needs rather than designing the processing operations to fit the physical configuration of the vessel. The high cost of construction along with the extent of the construction time would be the most detrimental factors.

Capital Costs of Vessels

In determining the size of vessel required, several factors had to be considered. Initially, the vessel would have to be sufficiently stable to allow processing operations to continue with the least amount of interruptions. There would have to be enough room for crew's quarters, processing equipment and freezer space to accommodate the expected through put of fish. However, if the vessel were too large there would be much wasted space, as well as, consuming considerably

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[1]Carl Sobremisana, Port and Intermodal Development, Maritime Administration, New York, personal communication, 1980.

[3]Ibid.

more fuel than would be consumed with a proper size vessel. In the construction of a new vessel wasted space on board can substantially increase the building cost.

Existing foreign-built processing vessels may not vary significantly between varying sizes of vessels. The cost of these vessels are primarily based upon the condition and the age of the vessel, the processing and freezing equipment on board, as well as, that country's worldwide fishing status and the current exchange rate with the U.S. dollar. Size would not necessarily be a deciding factor in price.

Foreign-built processing vessels have been on the market for between $600,000 to almost $3 million.[1] The lower range vessel is almost thirty years old, whereas the vessels at the upper end of this range are about ten years old.[2]

An existing merchant-type vessel would primarily be based upon the condition, the demand for that class vessel, and somewhat on the current scrap iron prices. The condition of these vessels can vary tremendously as do the prices. In the lower price range (i.e. less than $2 million) there are a variety of vessels that are on the market.[3] The total cost determination involved with the conversion of an existing vessel into a processing vessel is influenced more by the conversion costs than by the actual purchase cost.[4]

The selection of a merchant-type vessel should be based primarily

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[1]J. Gibson Johnston, Ltd., Hull, England, personal communication, 1979; and British United Trawlers, Hull, England, personal communication, 1979.

[2]Ibid. [3]Boats and Harbors, 1979.

[4]Edward Sanchez, personal communication, 1979.

Secondly, there should be a pre-determined lower size limit deemed acceptable. The prices for ex-merchant ships range from as low as $200,000 on upwards. Obviously, the lower-priced vessels will entail the most amount of conversion and consequent costs. A naval architect and a shipyard owner has indicated that a processing vessel "ready-to-go" could be purchased and converted for a total of $3.0 to $3.5 million.[1]

The cost of construction of a new vessel of adequate dimensions is rapidly increasing. Current estimates for a new processing vessel range from $8 million to $12 million.[2] This approach is a very expensive one to follow, however, there may be certain corporate structures, loan packages, tax credits and/or tax deductions that could offset this cost considerably.[3]

The first two options above are relatively similar in costs for a "ready-to-go" vessel. The third option may be similar with various financing methods. However, this study will base its calculations upon a vessel with capital costs about $3.5 million.

Operating Schedule of Processing Vessel

The proposed operating schedule of this vessel will be three week processing trips with an in-port period of up to one week. It is expected that the nonproductive steaming time will total about 3 days per trip. While on the fishing grounds there will be flexibility

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[1]Edward Sanchez, personal communication, 1979; and Jonathan Leiby, naval architect and marine engineer, Woods Hole, Ma., personal communication, 1979.

[2]Robert Stokes, "Prospects for Foreign Fishing Vessels in U.S. Fisheries Development," Marine Policy (January 1980): pp.33.

[3]More information on the financing of the construction or reconstruction of vessels is presented in Appendix A.

of movement. However, the processing operations are expected to continue while the vessel is moving about with the fishermen. Therefore, during the three-week trips there is expected to be about 18 days of processing activity.

The processing vessel will only be engaged in the Georges Bank herring fishery during the late summer and fall. The Council in devising the stock rebuilding programs for both the Georges Bank herring stock and the Gulf of Maine herring stock has assumed annual catches on Georges Bank for 1978 to 1982 to reflect the activities of 100 vessel trips during a two-month period (September and October) averaging 80 MT per trip (8,000 MT per year).[1] This study will extend this time period by proposing a vessel operation in the Georges Bank herring fishery from mid-August through the end of November. The vessel is projected to conduct four processing trips to Georges Bank during this time period.

This study will present two economic analyses of a processing vessel's operations. The first one analysis will assume that the vessel will solely be operating in the Georges Bank herring fishery for the time period stated above. In this analysis all the fixed costs will be deducted from the revenues derived from the herring operation. The vessel will not be in operation during the remainder of the year.

The second analysis assumes that the vessel will participate in other fisheries during the remainder of the year. The fixed costs, therefore, will be figured on a pro rata basis in relation to the full year. The vessel will be conducting seven other processing trips in other fisheries during the remainder of the year. The fixed costs for

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[1]Management Council, Herring Management Plan, p.2-38.

the proposed Georges Bank full herring fishery in this study will be calculated at 4/11 of the total yearly cost for that particular item. Neither the revenues nor the variable costs from these other operations will be calculated into this analysis.

Size of Vessel and Processing Capacity

In consultation with a shipyard, naval architect and processing equipment personnel it was determined that the proposed processing vessel should be 275' to 325' long and have a gross tonnage of 2,000 GRT to 2,500GRT.[1] This size range of vessel will permit the needed stable platform for operations, enough quartering space for the ship's personnel, sufficient area and space for the processing and freezing equipment and a fuel efficient main engine.

The herring brought aboard the processing vessel will be filleted, or headed and gutted and frozen, frozen in whole form and/or reduced to fish meal and fish oil. The processing vessel will be able to handle up to 100 MT of raw herring per day. The actual amount of herring resulting in any particular product is based upon the size mix of the catch. The smaller adult herring, about 9-11 inches long, will be either frozen whole or headed and gutted and frozen. Larger herring will be primarily filleted with some amounts being frozen in either the H & G or whole form. The offal and the damaged fish will be reduced to fish meal and fish oil.[2] This study used the historical processing mix of the New England processing industry as an indication of the

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[1]Edward Sanchez, personal communication, 1979; Jonathan Leiby, personal communication, 1979; and Micheal Collins, President, Hydramer, Inc., Newport R.I., personal communication, 1979.

[2]Ed McLeod, personal communication, 1978.

ratio of products resulting from the mix of herring sizes (see Table 6). The 100 MT per day capacity translates into a maximum daily production of 30 MT of fillets, 7 MT of H & G's, 13 MT of frozen whole herring and 50 MT of offal that will be reduced to 9.5 MT of fish meal and 5 MT of fish oil.[2]

Percent Operating Capacity

There will be times that the processing vessel will not receive enough fish from the harvesting vessels to be able to operate at 100% of processing capacity. There will also be periods of machinery breakdown and jamming. For the first year of operation, therefore, this study will expect that the vessel only will average 55% of its actual processing potential.[2] This 55% average will be referred to as the "percent operating capacity" for the first year. In subsequent years the percent operating capacity is projected to increase.

The projected second year of operation will have a percent operating capacity of 65%. The vessel will be more established in the viewpoint of the fishermen, will be more synchronized with the fishing vessels' operations and will have worked out some of the snags in the processing equipment and operation. Weather and overall herring supply, though, will be two major factors that are uncontrollable and will have very definite and serious consequences for the processing vessel operation.

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[1]Micheal Collins of Hydramar, Inc. in Newport, R.I. had calculated that this size vessel would be able to handle a production of 30 MT of fillets per day along with the production of other associated herring products.

[2]National Marine Fisheries Service, Gloucester, Ma., personal communication, 1979; Robert Taber, commercial fisherman, Wakefield, R.I., personal communication, 1979; and Tom Dykstra, commercial fisherman, Wakefield, R.I., personal communication, 1979.

Distribution to Market

The herring products processed on board the processing vessel has several options for distribution. These options include: the transport by the vessel itself to a West German port for delivery; the at-sea transfer of the products to a freighter or container ship heading to West Germany; the at-sea transfer of the products to a coastal feeder service; the delivery to New York or Boston for transshipment to West Germany; and/or offloading back in port to be transported by either truck or sail to a port for subsequent shipping to West Germany. All of these options are based upon the ultimate market destination of West Germany.

The processing vessel could actually deliver the herring, itself, to the intended West German port and, therefore, would receive the CIF price at the West German port for the herring products. The advantage to this approach is that the cargo will only have to be handled once. The product will also not have incurred any storage/inventory costs on shore or any handling/transportation charges. Obviously, there will be additional costs involved with the actual transportation across the Atlantic, but that could be offset by arranging for a return cargo from Europe. A disadvantage to shipping direct by the processing time while in transit. This would not be any problem if the vessel were only participating in the fall herring fishery. However, the vessel could be losing processing opportunities if it were participating in other fisheries during the remainder of the year. Scheduling could alleviate this problem, though, such as if the November herring trip was the last trip for the year. The vessel would be headed to shipyard for the winter and, therefore, would not be sacrificing

time from the other fisheries. Another disadvantage is the possibility of problems with the shipping conferences. It is very possible, however, that any proolems with shipping conferences could be worked out adequately.

The processing vessel operators could arrange for the at-sea transfer of the herring products to a container ship or freighter heading to West Germany. The advantage to this possibility is the decreased handling, storage and transportation of the product. There are possible logistical problems as to synchronization of the ship's voyage with that of the processing vessel, and, in regards to the actual physical transfer at-sea. Container transfer would be the quickest, however, it may not be the easiest in the event of adverse weather.

The McAllister Shipping Company and the Moran Shipping Company provide container feeder services along the East Coast. They operate with a tug/barge system. The Maritime Administration is interested in the possible promotion of organizing the at-sea transfer of the herring products to the container barge for delivery to Boston, New York or any major shipping port.[1] This operation would eliminate some of the handling/transportation costs, and some of the storage costs. Logistic problems similar to thou mentioned above for at-sea transfer, however, would still need to be surmounted.

The processing vessel could deliver the product to the U.S. port of shipping. This option could eliminate some logistical problems and could eliminate or reduce the handling, transportation and storage costs. There would be additional costs, though, involved with port

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[1]Carl Sobremisana, Port & Intermodal Development, Maritime Administration, New York, personal communication, 1980.

charges and general vessel expenses while in transit from the fishing grounds to the desired port.

The processing vessel could deliver the product to its own home port and base of operations. The product would need to be offloaded, stored in a freezer and subsequently transported to a U.S. port for shipping overseas. This option would entail the least amount of logistics, as well as, allowing more control of product movement in reaction to market conditions. However, this option may result in a higher overall cost, due to the increased costs of handling, transportation and storage.

In the economic analysis of the processing vessel operation this study will base its figures and costs upon the distribution of the product through the home port of operations. This basis will result in a higher cost but with the least possible logistical problems. The advantages and disadvantages of each option would need to be addressed in regards to the actual operation of the processing vessel.

With any of the above options the processing vessel will need a base of operations or a home port. There are several possibilities in southern New England that will be discussed in the next section.

Operational Bases

There are several potential bases of operation in southern New England. In Rhode Island these sites include: a.) Quonset Point/ Davisville in Northe Kingstown; b.) Coddington Cove in Middletown; and c.) Melville in Portsmouth. These are ex-Navy properties. Berthing is adequate at all three sites. Shoreside facilities are mostly similar with regards to normal utilities. The pier surfaces are largest at Quonset/Davisvilles and smallest at Melville. Only Coddington Cove

offers freezer facilities close to the pier. At all three sites the frozen product can be easily transported by the truck or rail systems. The access to these rail and highway systems is the best at Quonset/ Davisville. Obviously, other factors such as leases for shoreside facilities and space, leases for dock space itself and support activities would have a determining factor on desirability of the sites.

Marine Terminal, Inc. in New Bedford, Ma. can offer adequate berthing, freezer and support facilities at its plant on Whaler's Wharf.[1] There is adequate access to the highway and rail transportation systems in New Bedford. This study is unaware of other dock space in New Bedford that is either adequate or available for such a large vessel. Shoreside space is in tight supply in New Bedford.

New London, Ct. has expressed a strong interest in the development of a fishing industry to be based in that city.[2] Again the access to the highway and rail systems is very good. At this time this study is unsure as to what docks or facilities will be made available. The next few years will see a strengthening of New London's interest in the fishing industry and, therefore, a potential base for operations.

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[1] G. Robert Hampson II, President, Marine Terminal, Inc., New Bedford, Ma., personal communication, 1980.

[2] Stephen Sedgwick, Coastal Resource Center, University of Rhode Island, personal communication, 1980.

Ship's Crew

On a vessel of this size tonnage and horsepower there would need to be U.S.C.G. licensed or registered ship's crew totalling about 25 persons. The ship's crew will be responsible for the ship's operation and well-being. All topside and deck work will be conducted by the deck department, including the transfer of fish from the catcher vessels. All ship's machinery including the main engine, generators, heating systems, air conditioning and freezer equipment, among others, will be the responsibility of the engineering department. The steward department will be responsible for all "hotel" functions and needs of the ship's personnel on board including meals and linen.

The ship's crew will work the normal sea-watches of 4 hours on and 8 hours off while at sea. The crew will receive time and a half overtime for any time over 8 hours per day or over 40 hours per week. Saturdays, Sundays and holidays will be at overtime pay. The crew will have the opportunity to work overtime while at sea.

The ship's crew will be expected to work during the in-port periods. There will be no vacation pay or fringe benefits if the vessel only operates for the three-month period of the Georges Bank herring fishery. If the vessel operates year round then the accrued vacation pay and fringe benefits will be calculated at a rate of 30% of total wages and will be added to the costs for this three-month period. The projected wages and personnel composition of the ship's crew is detailed in Table 7.

TABLE 7

SHIP'S CREW

(dollars)

	hour	base week	OT/ week	at sea/ week	total[a]
Deck Department					
Master	21.90	876			14,900
First Mate	7.50	300	338	638	9,200
Second Mate	6.37	255	287	542	7,800
Third Mate	5.75	230	259	489	7,000
Boatswain	5.00	200	225	425	6,100
Able-bodied (3)	4.12	165	185	350	5,000
Ordinary (3)	3.77	151	170	321	4,600
Radio Officer	6.87	275	165	440	6,700
Engineering Department					
Chief Engineer	20.00	800			13,600
First Assistant	7.50	300	338	638	9,200
Second Assistant	6.37	255	287	542	7,800
Third Assistant	5.75	230	259	489	7,000
Refrigeration Engineer	5.00	200	225	425	6,100
Electrician	5.40	216	243	459	6,600
Oiler (3)	4.20	168	189	357	5,100
Steward Department					
Steward	5.62	225	253	478	6,900
Second cook	4.62	185	208	393	5,600
Messmen (2)	3.77	151	170	321	4,600

Total wages

without vacation pay or fringe benefits	$167,800
with vacation pay and fringe benefits	$218,100

[a]The total is figured to include 12 weeks of at-sea working time and to include 5 weeks of in-port working time.

Processing Crew

In addition to the ship's crew there will be a separate processing crew consisting of 25 persons, headed by a factory manager. The processing crew will be responsible for the fish as it comes below deck through to the freezers. The factory manager in conjunction with the vessel's Master will be responsible for the weighing and tabulation of the fish at both ends of the processing lines. The Master will disburse payment to the fishermen for the purchased fish.

The processing crew will work 10-hour shifts. Each shift will consist of a shift supervisor and eleven persons operating the processing equipment. They will receive overtime pay of time and a half for any time over 8 hours per day and over 40 hours per week. Saturdays, Sundays and holidays will be at overtime pay.

The processing crew will primarily be working only while the vessel is at sea. There will be some circumstances where part of the crew will work while the vessel is in port. Vacation pay and fringe benefits will be calculated in the same manner as with the ship's crew. The projected wages and personnel composition is detailed in Table 8.

Fuel Consumption and Costs

Fuel costs are a major consideration in the operation of a fish-processing vessel. Without a specific ship to calculate fuel consumption, some general assumptions will have to be made. These assumptions were determined based upon and in conjunction with data and experience from vessel owners and operators of vessels of various sizes and horsepowers. These initial assumptions will be calculated according to an industry ratio of fuel consumption of 0.4 lb. of fuel per

TABLE 8

PROCESSING CREW

	(dollars) hour	base week	OT/ week	at-sea/ week	total[a]
Processing Department					
Factory Manager	16.80	672		672	9,400
Supervisor (2)	6.50	260	293	553	7,200
General Workers (22)	5.50	220	248	468	6,100

Total wates:

without vacation pay or fringe benefits	$158,000
with vacation pay and fringe benefits	$205,400

[a]The total is figured to include 12 weeks of at-sea working time and to include 2 weeks of in-port working time.

horsepower per hour of operation with one pound of fuel equaling 7.5 gallons.[1] These resulting consumption figures will be priced at $1.25 per gallon for 1980 and $2.50 per gallon for 1981.[2]

The main engine for this size processing vessel is predicted to be about 2,000 shaft horsepower.[3] The main engine will vary from operating at full power while steaming to essentially idling while on station. The overall average operating power for the duration of the trips is projected to be about 50% of full power, that is, essentially 1,000 Hp on an average will be used.[4]

For the processing equipment, freezers, winches, etc. an electric generating capacity of 1,000 KW is projected.[5] The fuel consumption per kilowatt varies between the different manufacturers and the models of generators. An average ratio for fuel consumption for 100 KW generating capacity is that it is essentially equivalent to a 125 Hp engine.[6] Therefore, the projected 1,000 Kw generating capacity of this

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[1]Cliff Buehrens, Marine Superintendent, University of Rhode Island, personal communication, 1979; and Edward Sanchez, personal communication, 1979.

[2]The price for fuel in Pt. Judith is presently $.92 per gallon, however, by June 1980 the price is expected to rise to $1.25 per gallon and up to $1.75 per gallon by December 1980. Fuel prices are expected to rise to $2.75 per gallon by the end of 1981. Edward Laughlin, Energy Specialist, NMFS, quoted in Maine Commercial Fisheries, April 1980, p.1.

[3]Jonathan Leiby, personal communication, 1979.

[4]Edward Sanchez, personal communication, 1979; and Jonathan Leiby, personal communication, 1979.

[5]Ibid.,

[6]Edward Sanchez, Jr., Sanchez Marine Company, New Bedfor, Ma., personal communication, 1980.

vessel is essentially equivalent to 1,250 horsepower in terms of fuel consumption. Generators operate most efficiently at a load of 90% to 100% of their output capacity.[1] For this study an average load of 90% will be used. The calculations for the overall fuel consumption for the operation of this processing vessel for the fall Georges Bank herring fishery is detailed in Table 9.

Food Consumption and Costs

Food consumption for this vessel is figured upon providing three meals per day for 50 persons while at sea and three meals per day for 25 persons while in port at a cost of $12 per person per day.[2] The ship's crew will be provided with meals while in port, also. The processing crew will only be fed while the ship is at sea or while they are working when the ship is in port. The overall food consumption and costs are detailed in Table 10.

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[1]Ibid.

[2]Dick Edwards, Marine Superintendent, Woods Hole Oceanographic Institution, personal communication, 1979; and Cliff Buehrens, Marine Superintendent, University of Rhode Island, personal communication, 1979.

TABLE 9

FUEL CONSUMPTION AND COSTS

Main Engine:

2,000 Hp @ 50% capacity for 2,016 hours (four 21-day trips)

0.4 lb./Hp/hr. 7.5 gallons/lb.

total consumption equals 806,400 lbs. or 107,520 gallons

Generators:

1,000 KW @ 80% capacity equivalent to 1,125 Hp for 2,016 hours

total consimption equals 907,200 lbs. or 120,960 gallons

Grand Total: 228,500 gallons

1980: @ $1.25 per gallon = $286,000

1981: @ $2.50 per gallon = $571,000

TABLE 10

FOOD CONSUMPTION AND COSTS

At Sea:

50 persons @ $12/day equals $4,200/wk.

12 weeks @ $4,200/wk. equals $50,400

In Port:

25 persons @ $12/day equals $2,100/wk.

5 weeks @ $2,100/wk. equals $10,500

Grand Total: $61,000

CHAPTER IV

FINANCIAL ANALYSIS

Fall Herring—Sole Operation

Table 11 represents the pro forma financial sheet for a processing vessel operating solely in the fall Georges Bank adult herring fishery. The derivation of the Revenues is provided in Table 13 in appendix B. The individual items in Table 11 are explained in Table 14 in appendix B.

The financial markets in the U.S. are presently in a state of flux. Interest rates, corporate bonds and credit are all changing daily. Therefore, this study will not propose either a capitalization or a corporate structure for these processing vessel operations. Without these formations this study will base its analysis upon the Operating Income or the EBIT (Earnings Before Interest and Taxes).

By operating solely in the fall herring fishery on Georges Bank the fixed costs of repair/maintenance, ship's gear, insurance, miscellaneous and depreciation are totally supported the four processing trips to Georges Bank. This operational set-up results in a first year deficit of $466,000 for 1980. It is expected that the first year of operation will be a shakedown period to work out operational inefficiencies and organizational problems. However, the vessel is not expected to operate at a greater deficit during the second year (1981) of operation. The deficit for 1981 is projected to be $536,000.

The fixed cost obligations can be expected to produce a deficit

TABLE 11

PRO FORMA FINANCIAL SHEET FOR VESSEL
SOLELY IN FALL HERRING FISHERY
(figures in thousand of dollars)

	1980 55% op. cap.		1981 65% op. cap.	
Revenues:				
fillets	1711		2260	
H&G	286		389	
whole	307		459	
fish meal	150		181	
fish oil	100		112	
Total:		2544		3401
COGS:				
raw fish	689		983	
packaging	198		257	
handling/transp.	198		257	
inventory/storage	150		206	
processing crew	158		174	
sub total		1393		1877
Ship's Operation				
crew	168		185	
fuel	286		571	
food	61		68	
repair/maintenance	125		200	
ship's gear	125		175	
insurance	100		125	
miscellaneous	300		250	
depreciation	350		350	
sub total	1515		1924	
Gross Profit		(364)*		(400)
Sales/General Administration:				
gen. admin.	64		85	
marketing	38		51	
Operating Income/ EBIT		(466)		(536)

*Parantheses indicate losses.

for this operation. However, in relation to the overall inflation with all items and the increased operating capacity in 1981 these obligations should not create a larger deficit for 1981. The projected increase in fuel costs of 100% from 1980 to 1981 (see Fuel section) without a corresponding jump in the overall inflation rate is the major reason for the larger deficit in 1981.

Fall Herring—Conjunction with other Fisheries

Table 12 represents the proforma financial sheet for a processing vessel participating in the fall Georges Bank adult herring fishery and participating in alternative fisheries during the remainder of the year. The data in Table 12 only relate to the revenues and costs incurred during the herring-processing operation of the vessel's total yearly operations. The derivation of the Revenues is exactly the same as for Table 11, and is provided in Table 13 in Appendix B. The individual items in Table 12 are explained in Table 14 in Appendix B.

This proposed vessel operation is essentially the same in respect to the variable costs, the cost-of-goods-sold, the fuel costs and the food costs. However, the ship's crew and the processing crew costs are higher due to the inclusion of fringe benefits and vacation pay in the data for Table 12. The primary and financially significant difference is that the fixed costs for this operation are prorated for the four trips spent in the fall herring fishery. The remaining seven trips share the burden of these fixed costs. Therefore, in analyzing this vessel's proposed participation in the fall herring fishery the fixed costs do not have such a determining influence as in the previous section.

TABLE 12

PRO FORMA FINANCIAL SHEET FOR VESSEL
IN CONJUNCTION WITH OTHER FISHERIES
(figures in thousand of dollars)

	1980 55% op. cap.		1981 65% op. cap.	
Revenues:				
fillets	1711		2260	
H&G	286		389	
whole	307		459	
fish meal	150		181	
fish oil	100		112	
Total:		2544		3401
COGS:				
raw fish	689		983	
packaging	198		257	
handling/transp.	198		257	
inventory/storage	150		206	
processing crew	205		225	
sub total		1440		1928
Ship's Operation:				
crew	218		240	
fuel	286		571	
food	61		68	
repair/maintenance	56		88	
ship's gear	56		80	
insurance	45		56	
miscellaneous	88		72	
depreciation	127		127	
sub total		937		1302
Gross Profit		167		171
Sales/General Administration:				
gen. admin.	64		85	
marketing	38		51	
Operating Income/ EBIT		65		35

Most of the overall yearly costs for these fixed items in Table 12 are higher than for the corresponding fixed items in Table 11. This represents the added increase in these costs associated with a full year of operation in processing activities. However, when prorated for the 4-trip herring fishery these costs are significantly less in Table 12 than they were in Table11.. The Miscellaneous costs are higher for the previous section because of the inclusion of wharfage and lay-up charges of the vessel for 8 months per year.

In the first year of operation (1980) the processing vessel produces a positive Operating Income of $65,000 for the fall herring operations of its overall yearly activities. However, the 100% increase in fuel costs from 1980 to 1981 without any corresponding increase in the overall inflation rate more than offsets the increased benefits received from the higher operating capacity for 1981. The Operating Income for 1981 actually drops $30,000 to a total of only $35,000 for its herring processing operations.

Comparison of Operations

As discussed above a processing vessel operating solely in the fall Georges Bank herring fishery will be in financial difficulty for several years. The primary reasons would be the total burden of the fixed cost obligations supported totally by these four processing trips, along with the 100% predicted increase in fuel costs. Assuming that these fuel increases do not create a corresponding increase in the overall inflation rate for the other costs and revenues, this sole fall herring fishery operation does not appear to be a feasible alternative. However, because rising fuel costs do generally stimulate inflation this alternative should not be totally disregarded, but should

be recalculated in response to updated fuel costs and inflation rates. Some costs involved with the 4-trip operation could be reduced by means of alternative transportation and delivery of the product to the West German market. By utilizing one of these alternatives, as explained previously, the handling/transportation and inventory/storage costs could be reduced substantially. But, as mentioned previously, there could be other costs involved with these alternatives that could outweigh any advantage gained through the use therof.

Revenues could be increased by improving efficiency and increasing the throughput of fish per day. The vessel operators should already be striving to improve the efficiency of operations, as well as, trying to increase the throughput of fish per day. The prices received for the products will be based upon the world market and, therefore, the vessel operators will not have a strong input in the determination of prices.

The operation of the processing vessel in alternative fisheries during the remainder of the year holds a lot of potential for operation. The assumption is made, however, that the participation in these other fisheries produces a positive Operating Income. The distribution of the fixed costs over a full year of operation provides for a greater opportunity for a secure operation.

The increase of fuel costs creates the decrease in Operating Income from 1980 to 1981 for this year-round operation. However, as pointed out above, if the rise in fuel costs stimulates the overall inflation then the Operating Income should be increasing during the second year of operation in comparison to the first year.

This operation could also benefit from utilizing an alternative means of delivery to a West German port. The benefits, of course would need to be weighed against any added costs involved with the specific alternitive.

CONCLUSION AND IMPLICATIONS

Through the examination in Chapter I of the adult herring resource on Georges Bank this study concludes that the supply of herring is adequate for the proposed vessel operations. The potential for even greater harvests of adult herring from Georges Bank allows for significant expansion possibilities of processing operations. A greater abundance of adult herring will allow the fishermen to be able to supply enough herring on a steadier basis to allow for an increase in the overall percent operating cpapcity of the processing vessel.

In Chapter II this study examined the markets for the products produced on board the processing vessel. The West German market in the primary market for herring exports from the U.S.. From the expanding size and desire of the West German herring market it is concluded that the products from the processing vessel operation will be absorbed adequately and easily into this market.

Several alternatives, as detailed in Chapter III, are for the purchase and operation of a U.S.-flag, herring-processing vessel. This study will not recommend any alternative over another, but will conclude that through one of these alternatives a reasonably priced processing vessel can be put into operation for herring on Georges Bank.

In the analysis and comparison of the financial sheets for the two proposed processing operations this study concludes that a processing vessel needs to be in operation for as much of the year as feasibly possible. There are several possibilities of operations that could

result in increased Operating Income, but each possibility will need to be analyzed individually in regards to the actual operation of a processing vessel seek other viable and similar fisheries in which to participate during the remainder of the year from the fall herring fishery.

The overall conclusion of this study is that a herring-processing vessel operating part of the year in the fall Georges Bank adult herring fishery can be financially feasible and beneficial. It will initially be beneficial to the operators of the vessel, the employees of the company and to the support industries involved with vessel operators. Benefits will also be received by the fishermen through the existence of a ready market at sea for the adult herring they harvest on Geroges Bank. The U.S. economy will benefit from the projected $2.5 million and $3.4 million positive impact upon the U.S. balance of trade for the years 1980 and 1981, respectively.

APPENDIX A

Financing

The U.S. government provides several financing programs designed to assist both the fishing industry and the maritime industry. Some of these programs are primarily intended for fishing vessels, whereas, some are primarily intended for application to the maritime shipping industry. As a fish-processing vessel, the proposed operations in this study fall within both of the above categories. A foreign-built vessel may be acceptable for some of these programs, but, will definitely be excluded from others. This study will only list the available programs. For detailed applicability to a specific vessel operation this study suggests contacting the nearest office of the agency listed.

Economic Development Administration

Title IX -- Special Economic Development and Adjustment Assistances Program

Business Development Loan Program

Title I

Farm Credit System

Federal Inermediate Credit Bank

Production Credit Association

Farmers Home Administration

Business and Industrial Loans

Housing and Urban Development

Community Development Block Grants

Maritime Administration

Capital Construction Fund

Construction — Differential Subsidies

Development and Promotion of Domestic Waterborne Transport Systems

Development and Promotion of Ports and Inermodal Transportation

Federal Ship -- Financing Guarantees

Maritime War -- Risk Insurance

Operating -- Differential Subsidies

Ship Sales

National Marine Fisheries Service

Fishing Vessel Obligation Guarantee

Capital Construction Fund

Small Business Administration

Direct Business Loan and Loan Guarantee

Local Development Companies

Disaster and Economic Injury Program

SOURCE: Earl R. Combs, Inc., Export and Domestic Market Opportunities for Underutilized Fish and Shellfish (Washington, D.C.: Government Printing Office, 1978) p. 293; and Richard Sisco, Sources of Capital (University of Rhode Island, 1980) p. 39.

APPENDIX B

TABLE 13

DERIVATION OF REVENUES

1980: 55% operating capacity
100 MT total processing capacity per day

	MT/day	MT/trip	MT/year	$/ton	$/year
fillets	16.5	297	1,188	1,440	1,711,000
H&Gs	3.8	68	272	1,050	286,000
whole	7.1	128	512	600	307,000
fish meal	5.2	94	376	400	150,000
fish oil	2.75	50	200	500	100,000
total					2,554,000
raw herring	55		3,960	174	689,000

1981: 65% operating capacity
100 MT total processing capacity per day

	MT/day	MT/trip	MT/year	$/ton	$/year
fillets	19.5	351	1,404	1,610	2,260,000
H&Gs	4.5	81	324	1,200	389,000
whole	8.5	153	612	750	459,000
fish meal	6	108	432	420	181,000
fish oil	3	54	216	520	112,000
total					3,401,000
raw herring	65		4,680	210	983,000

TABLE 14

EXPLANATION SHEET FOR FINANCIAL SHEETS

Operating Capacity:	As detailed in the text the operating capacity for 1980 is 55% and 65% for 1981. These capacities relate into a raw herring supply of 55 MT per day for 1980 and 65 MT per day for 1981.
Fillets, H&Gs, whole, fish meal, and fish oil:	These figures are derived from the expected supply of 55 MT and 65 MT of herring per day for 1980 and 1981, respectively. The percentages resulting in each of these items are calculated from the ratios outlined in Table 6. These tonnages are figured out for 18 days of processing for four trips. These figures were then multiplied by the dollars per ton projected in Figure 5 for fillets and H&Gs and in Figure 6 for fish meal and fish oil.
Raw Fish:	Raw herring supply was projected to be 55 MT and 65 MT per day for 1980 and 1981, respectively. This supply was calculated for four trips of 18 days of processing per trip. The prices per ton were projected in Figure 2.
Pakaging:	Packaging costs are based upon 2¢/lb, estimates used in the Combs Report. Earl R. Combs, Inc., Export and Domestic Market Opportunities for Underutilized Fish and Shellfish, prepared under contract to NMFS (Washington, D.C.: Government Printing Office, 1978). These costs are adjusted at an annual 10% inflation rate.
Handling/ Transportation:	Handling and transportation costs of 2¢/lb. were used based upon estimates for these costs in the Combs Report. Cost is adjusted annually at 10% inflation rate.
Inventory/ Storage:	These figures were based upon an inventory cost of 1.5¢/lb. per month received from Merchant's Cold Storage in Providence, R.I..
Processing Crew:	Derivation of costs is explained in the text and in Table 8. Inflation of 10% per year is used to calculate the 1981 figures.
Ship's Crew:	Derivation of costs is esplained in the text and in Table 7. Inflation of 10% per year is used to calculate the 1981 figures.
Fuel:	Costs are explained in the text and in Table 9.
Food:	Costs are explained in the text and in Table 10.

Repair/ Maintenance:	The 1980 figures reflect the recent delivery of the vessel in relation to the 1981 figures. For Table 11 the cost is totally supported by the revenues from the Georges Bank herring operation. Table 12 reflects an increase cost due to the vessel's participation in other fisheries during the remainder of the year. This higher cost, in relation to the sole herring operation is calculated on a pro rata basis for thes 4 trips, in relation to 7 trips in other fisheries during the remainder of the year. These figures were based upon assumptions and data from the Port Offices at the University of Rhode Island and at the Woods Hole Oceanographic Institution.
Ship's Gear:	The 1980 costs reflect the recent delivery of the vessel, whereas, more gear is expected to be needed in the second year. Table 11 reflects the total annual cost of the ship's gear as supported by the Georges Bank herring processing operation. Table 12 reflects an overall increase of ship's gear costs to correspond to the increased usage of the vessel during the remainder of the year. These figures were based upon assumptions and data from the Port Offices at the University of Rhode Island and at the Woods Hole Oceanographic Institutuion.
Insurance:	Insurance costs are calculated to reflect the increased cost due to the increased yearly participation in Table 12. Table 11 only relates the insurance costs for sole operation in the Georges Bank herring fishery.
Miscellaneous:	These figures are estimates of general items not covered by any of the above. The larger costs in Table 11 represent increased wharfage charges due to the annual lay-up of the vessel for about 9 months of the year. Table 12 costs are prorated accordingly for the Georges Bank herring trips.
Depreciation:	The depreciation is based upon a useful life of 10 years for the processing vessel and equipment. It is calculated on a straight-line basis. The overall cost of the vessel is projected to be about $3.5 million.
General Admin:	The shoreside staff costs will be proportional to 2.5% of total revenues.
Sales/Marketing:	The costs of the sales/marketing staff will be proportional to 1.5% of total revenues.
Operating Income/ EBIT:	This is the earnings before interest and taxes are paid. From this amount the interst on long-term debt, taxes and dividends to shareholders will be deducted. Figures in parantheses are losses.

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